PENANG TO CALCUTTA

April 9, 1964 - off Penang —

A hair after 0900 the hook was up, our agent had left with the last of the mail, and we were headed out Northwest Channel from Penang. From the channel entrance we headed due north along 100° 8' E to start our run west along the six-degree parallel. We made our turn west and ran along fairly close to the isolated high islands of Paya and Sagantang, each covered with a thick growth of trees down their steep sides right to the water. We are now - 10 PM - moving along at 16 knots with PDR, gravity, and magnetics all clicking along.

make it Linberg throughout!

John Linberg from Raytheon was here when I came aboard last evening, and he, Reggie, Austin Weeks, and LtSa Toffler have been

hard at it up in the GEP shack. He has - evidently - found several things wrong with it. I have yet to get a meaningful - to me - explanation of what has been wrong since it conked out just out of Singapore. We've asked him to work with Reggie on a written summary of what was wrong and what has been done, so that we will hopefully be able to run it ourselves. Any new piece of gear is bound to give trouble, and this, it seems to me, is a basic fault with the system.

Burns and Kotter have also been at the thermoprobe. They now feel that the sequence switch really was off, but that the batteries while sitting on their sides in the recorder leaked enough to short out, thus when one thermister went out, the whole system

was shorted out. They are putting in new sealed batteries and will be ready to try it again tomorrow.

We held a long planning session in the ~~et~~ plotting room this morning and have our work to the Irrawaddy Delta planned on the assumption that the GEP will work and that the thermoprobe will work.

~~Those aboard have been~~

10 April 1964 – Andaman Sea (see p. 7)

We crossed at 9:30 PM last night the shelf break again, and it looked very similar to the previous ones. There was the sharp break at the shelf edge – where we dredged before – and the long gradual slope down into deeper water. About 3:30 AM this morning we picked up a sharp volcanic(?) peak with a 250-gamma magnetic anomaly. There is a good magnetic anomaly right where the bottom leaves the 600-fm area and starts down to the bottom of the Andaman Basin in about 1500 fms. George Peter feels that this is the northward continuation of the feature we found on our earlier crossings north of Sumatra, and I have asked him to plot up the hydrography, gravity, and magnetic

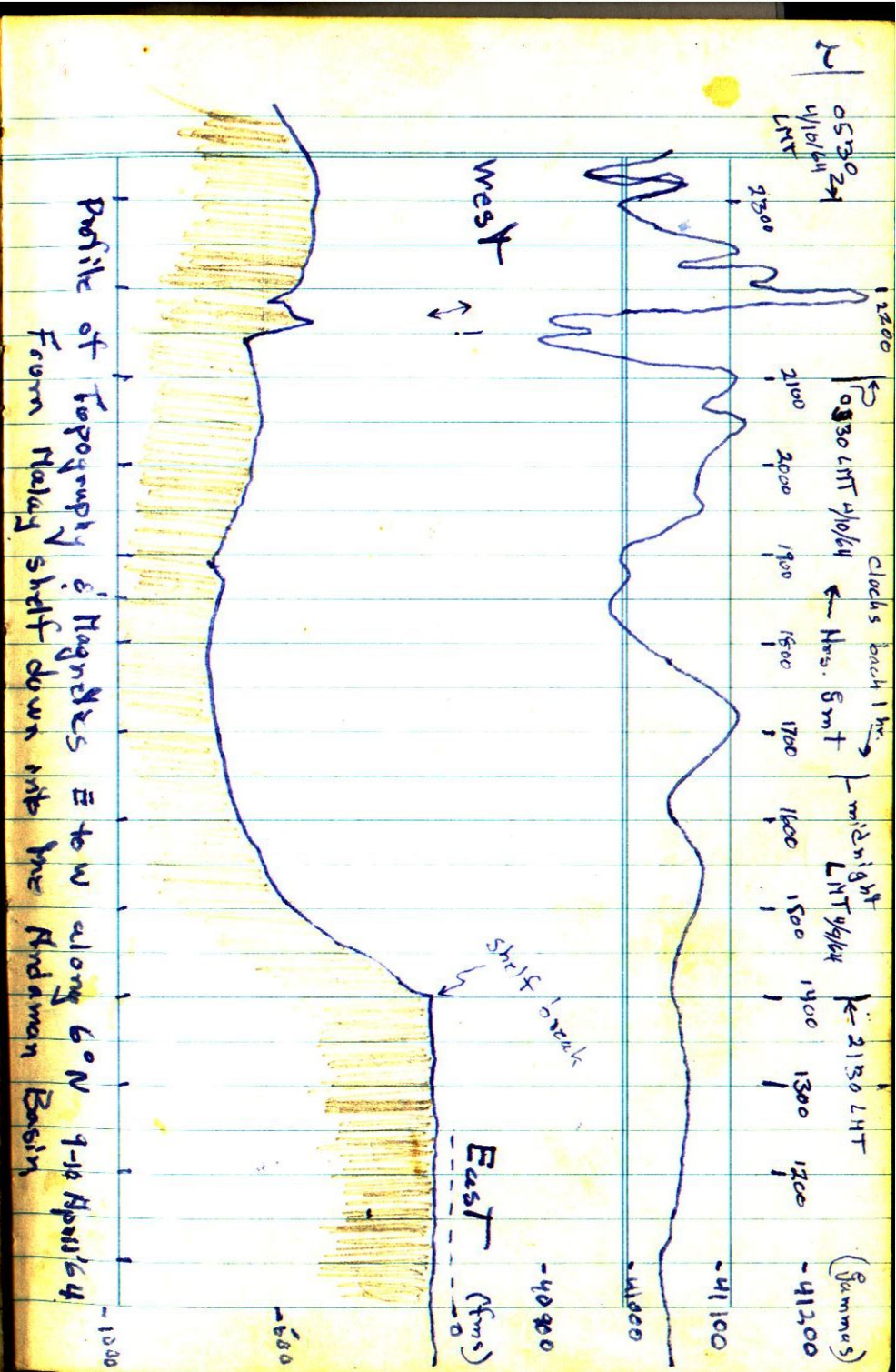
profiles so we can take a look at it. At Midnight we had changed course from 270° to 321° and angled to the northwest to start our GEP run in toward the Nicobar Islands.

Now at 9:20 AM we are ~~down~~ working our way down into the Andaman Basin. We are at 1360 fms and it has not yet started to level out. We routinely take surface salinity and temperatures every two hours, and now that we are back in water over 150 meters, we have added the bi-hourly BT's again.

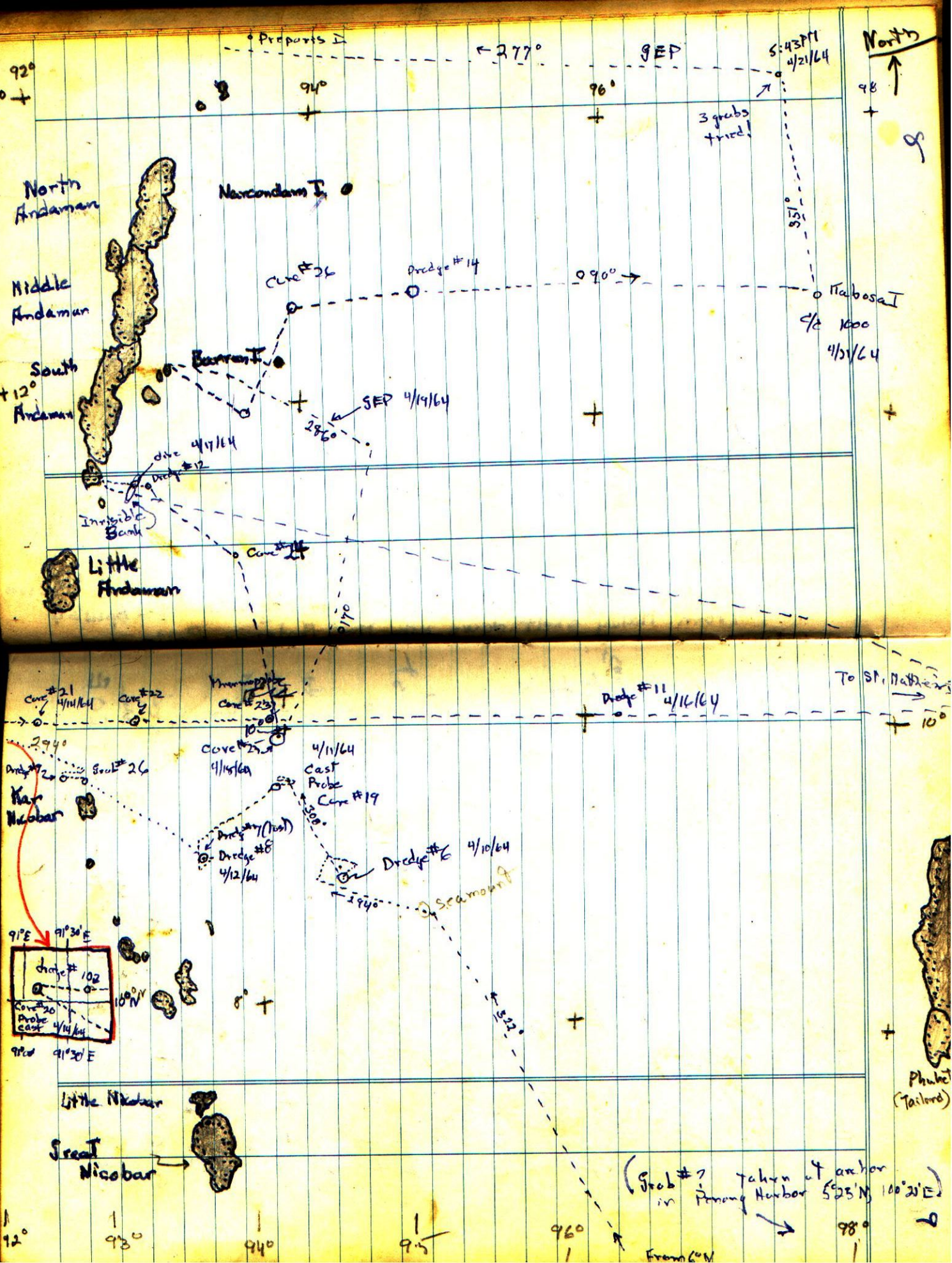
At 11:00 AM we streamed the ESP overside gear while Lindberg finished his final checks of the shipboard gear. Burns just popped in to say they had cut the fourth thermister out of the system and checked the thermoprobe again, and he believes it is ready to go again. It is now 1:40 PM and still the GEP is inoperative.

It is hot back there at the GEP shack and Harbison and Lindberg stripped to their shorts are dripping wet. I've kept away knowing they can do no more, and when it is ready, it will be fired off.

Meanwhile at 5 knots we have come up on a nice uncharted seamount at 08°35'N, 94°50'E. At 1240 P.M. ~~[illegible]~~ the bottom was at 1440 fms and started to rise. It peaked at 735 fms at ~~[illegible]~~ 1:17 PM and started down again. This is about on schedule as a crossing of the Sumatra - Barren I - Narcondam I volcanic trend, and we would have been dissapointed had we not found it about where we did. If the GEP had not been out, we'd have surveyed and dredged here, but there will be other opportunities later on ~~[illegible]~~, I'm sure. About 2:15 they fired up the ~~camp~~ GEP generator and began to get a record. They were still trimming it a bit, but there is a record



Profile of Topography & Magnetics E to W along 6°N 9-10 April '64
From Malay shelf down into the Andaman Basin



Preports I
← 277°
SEP
5:43PM 4/21/64
North
92°
94°
96°
98
3 grabs tried!
North Andaman
Narcondam I.
351°
Middle Andaman
Core #26
Dredge #14
090°
Kabosa I
c/c 1000 4/21/64
South Andaman
12°
Barren I.
SEP 4/19/64
286°
dive 4/17/64
Dredge #12
Invisible Bank
Core #24
Little Andaman
170°
To St. Matthews
Core #21 4/14/64
Core #22
Core #23
Dredge #11 4/16/64
10°
294°
Core #25 4/18/64
4/11/64 Cast Probe Core #19
Dredge #9
Grab #26
Kar Nicobar
Dredge #7 (lost)
Dredge #8 4/12/64
Dredge #6 4/10/64
294°
Seamount
91°E
91°30'E
Dredge #10
10°N
Core #20 Probe cast 4/14/64
8°
322°
Phuket (Tailored)
Little Nicobar
Great Nicobar
(Grab #? taken at anchor in Penang Harbor 5°23'N, 100°21'E)
92°
93°
94°
95
96°
98°
From 6°N

The GEP has worked satisfactorily all afternoon, and at 6:30 PM (1200 GMT) we secured the GEP preparatory to dredging. There is little need to go into the details of our search pattern which I maintained on a maneuvering board, the ups and downs of the bottom, our discussions and decisions for when the dredge came up at midnight there was nothing but mud on the bucket with not a scratch to be seen. No rocks.

During the recovery of the GEP, we left the magfish in the water. This was our first try at this, but CDR Cole had gone over the book, and it said that the fish is built to withstand considerably more than the 300 psi encountered if it sank the full 700 ft. to the limit of its tow cable. Once under way again, it was ok, so we used the same technique when we stopped at 8 PM for the IIOE

Standard Net tow. After this, however, we got too much "noise" in the magnetometer. That is the cable we banged up on Seahorse Shoal last month, and the pressure may have pushed some water into the cable. We will have to pull the spare cable while we are on station tomorrow.

Anyone who thinks this log might be a literary gem is in for a rude shock. It is intended as – and is – nothing more than a styleless chronicling of the events as they take place on a day to day basis. The purpose is to keep me occupied and to have an account less sterile – albeit less complete and less accurate – than the various ~~logs~~ official log books that must be maintained aboard. Maybe it will help some when we are trying to make sense out of these mountains of data later on.

11 April, 1964 - East of the Nicobars

Following the unsuccessful dredge last night, we put the GEP back out and poked along at 5 knots whipping away with the GEP - or 'gepper', as we now seem to be calling it.

Just went aft to the GEP shack and talked to Lindberg and Harbison about the night's run. They feel that it is working well and that they have good records. I'm afraid I do not share their optimism. To me the record was confused with background noise, penetration was discontinuous, the actual bottom was difficult to pick out, and I seriously doubt if - at least in this area - we are getting meaningful records - records, yes, but can they be interpreted to present new and meaningful information?

Now at 5:30 AM we are stopped on what will be a long station. This whole line will be long, and the full day on station will be hot and tiring. We plan a Nansen cast first, heat probe, and long piston core, and while these are going on the biologists will be doing an in situ productivity station of about 5 hours duration.

This last involves collecting plankton from five depths of measured light intensity, innoculating the samples with C-14, and then putting them back in situ in clear bottles beneath a buoy to incubate in the amount of sunlight at the depth from which they were originally recovered. This gives them a control against which to evaluate the results of their morning run and the surface samples they run during the day.

I just talked, too, with Bob Burns,

and he feels his thermoprobe is ready to go. He hopes Ted Ryan has not had comparable problems on the Surveyor. On return to D.C. Burns will re-wire the units and blast Alpine Geophysical for a poor job. He now feels that LTJG Hoffer is completely familiar with the gear and able to run the show himself after Burns has left at Calcutta.

Now at 1:30PM, the first or deep Nansen cast is coming in. The buoy with its suspended incubation bottles for productivity measurements in situ was tied to the rail on the foredeck when the wind shifted - as it did - our hydro wire trended under the ship and we ~~dared not try to~~ could not continue to recover Nansen bottles without scraping them off on the hull. With the productivity work going on atl, we couldn't maneuver to get the wire out, so we had to stop

and put over a skiff to tend ~~tende~~ the buoy after we cut her loose. Then we went astern ~~off~~ on our starboard engine and ahead on port, ~~and~~ the wire came away from the hull, and bottles are again coming in. Meanwhile, two seamen who said "no, we won't need our shirts" are getting nicely cooked in a skiff some 100 yards off our port quarter.

It was almost 9PM by the time we were underway to stream the GEP again en route to our next dredge station. It has been a full day on station, and the air now moving through the ship as we move along at four knots is a big relief.

The thermoprobe got our first record - at last - even though it was only on two of the four thermistors. The core had coarse material on the bottom, the productivity in situ station was OIT - as was a tow

with the IIOE standard net. In its barest summary, the day looks like this in retrospect:

(LMT)	
0950	Stop - BT# 257
1050	Start in-situ productivity station
1124	Deep cast messenger time
1:33PM	Deep cast in
1:39	Pinger aboard
2:07	Shallow cast messenger time
2:29	Shalow cast in
2:38	Thermoprobe over
2:51	Pinger in the water
3:25	Pinger at bottom
5:12	~~Shallow cast in~~ pinger aboard
5:18	Thermoprobe aboard
5:54	Piston corer in the water
6:55	Corer on bottom
8:20	Corer aboard
8:35	Start IIOE standard tow
8:54	IIOE net aboard
8:21	Underway streaming GEP and making horizontal plankton tow.

It's now 10 PM, and I have a 2 AM call in to prepare for the next dredge station. Clocks go back one hour at midnight!

12 April, 1964 SE of Car Nicobar I.

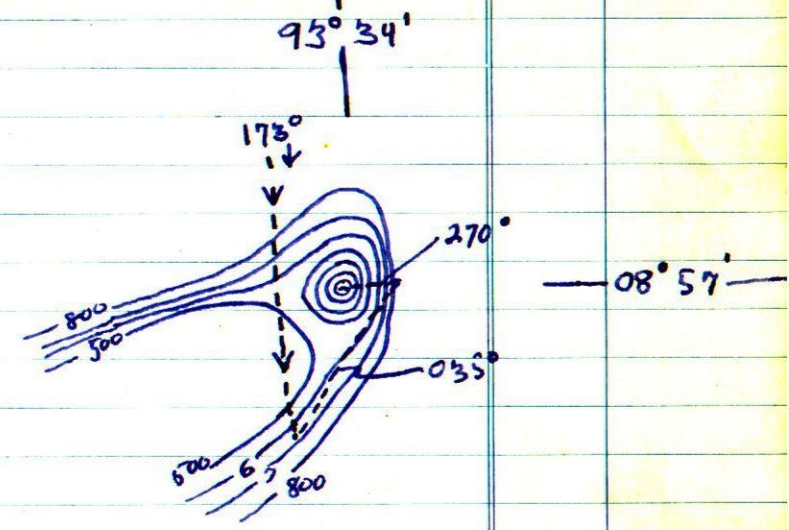
It is now nearly 4 AM, and we are awaiting first light of dawn so Rogers and I can ~~get~~ go over the side to unfoul the GEP sparker lines from the starboard screw! You win a few and you lose a few.

About 1:15 this morning, when I was called, the bottom had started to rise from a generally flatish bottom at 2200 fms. By 2:25 it was up to 1040 fms and we stopped for recovery of the GEP lines. The hydrophones out the port quarter came in OK, but during the all-hands pull-in of the starboard streamer, there was a sudden tension on the line, and she was hung. No amount of jockeying accomplished anything. Rogers just came in to say the gear is all ready, and we'll go over as soon as there is some light. Sunrise is due at 5:07 - in about a half hour, and all lights are now out back

aft so as not to attract any of the sharks that have been circling us for the last day or so whenever we stop on station.

It's now about 5:45. The GEP cable was well fouled with the starboard screw, but we were able, by bracing our feet against on blade of the propeller, to get enough pull to clear the tangle and let it fall free. We then checked the other screw, and all seems clear back there now, and the vertical productivity tow has started while the rest of the GEP is coming in. We may dredge yet. The water was clear but warm, and it was good to be diving again. The dive was for 12 minutes starting at 0500 AM.

It is now 10:15 AM, and I have yet to put head to pillow. Lt Dohrman got good morning stars about 5 AM that put us at 09°05' N, 93° 34' E or about 9 miles due north of where we expected to dredge.



We put over the productivity tow just after our dive, and at 0626 AM it was back aboard, and at 14½ knots we were headed south (173°) toward the dredge site. Our depth then was 815 fms. By 7:15 it was up to 500 fms in a jagged sort of profile indicative of hard bottom. By 0730, we had crossed the crest and were back down to 700 fms. ~~I felt~~ Barbee and I both felt that we had crossed just west of

\# the summit shown as 206 fms on the chart, so we headed back at 035°. The bottom came up, but not enough, so we felt we had bracketed the peak, and at the point in our DR track due east of the shoalest depth on our southerly leg we came left to 270° and did omit → indeed hit the top [(see p. 19)]. At two minutes after eight, we hit the top at just 60 fathoms, and almost immediately it dropped to 190 fms where we stopped at 8:15 to dredge. It looked like an excellent spot. Our drift was upslope. The bottom was at 284 fms during much of the dredge, even at the time of the monsterous hang-up, the great tension, the snap, and the accumulation of "rats nests" which developed immediately in the cable outboard of the head sheave. We had lost our dredge!

We still have three aboard, so I do not feel at all badly about losing this one. We were dredging well, we were obviously in rock — just what we wanted — and we had a fine hang-up — again just what we wanted. It so happened that the outcrop was tougher than the cable, but that is to be expected on occasions. It's our gamble with the seafloor, for rock dredging is always a gamble. You are betting a geological sample that your gear is tougher than the outcrop your sample is to come from. This time we lost.

The cable now is being run out to the 2590 feet where the first bad "adzohl" was and will be cut off. We can't risk all future deep sea operations by using cable that bad. Lavery's comment was "We'd just better leave enough on the drum to get down in the Mariana Trench!"

surfaced right off our bow. We were doing nearly 17 knots and were into them before we or they could do anything about it. They scattered, but we apparently hit one, for I could see a trail of blood from one as he slid by a couple of feet off the hull. They sounded almost immediately and within seconds of our first sighting them, they were gone, and the surface of the sea was calm again except for the occasional flying fish that breaks the surface and glides along to fall back in.

We picked up a good band of turbulent water along the east but not the west edge of Invisible Bank, so it isn't so invisible after all.

At 11:20 we had a good set of positions from Cinque Island and came right to 092° headed back to Invisible Bank and our dive site. Dick Stephen-Hassard talked to the Captain who OK'd his going with us to work at the surface. Tanks and gear are now in launch No. 4, and I'll get a crowbar and line so that we can have a better chance of recovering some museum specimen corals if we locate some.

Since George Peter has been keeping a geophysical log, I have not bothered to include much here of a purely geophysical nature. As I come in to switch to my scroungiest shorts for the dive, I found he had left on my desk his latest topography - magnetics - gravity profile. It covers the run all the way across from St. Matthew to Cinque I. Approaching Invisible Bank, the gravity increased from an average

He has the right approach – even if I did leave the more colorful words out of his quote.

While the dredge hassle was going on, Dugan on the big wrench console pointed out two good-sized fish going lazily by our starboard side. They were – to me – dolphin fish (not the dolphin mammal), but to the ~~Chinese~~ Filippinos and Hawaiians aboard they were mahi mahi, and the polynesian word bouncing back and forth in the galley and messing areas below brought a whole phalanx of anglers to the rail. Johnny was the first one there, and as his jig hit the water, both fish turned and streaked toward it. The bigger got there first and hit hard, and the reel sang as the line was pulled out. He carefully braked it to a stop, the beautiful fish turned, raced aft, and kept four feet clear of

the surface in a twisting jerking jump only to fall back with the hooks still in place. Back and forth he raced with a great heart-straining twisting leap on each traverse. After some 15 minutes he tired and was brought aboard. The blues and yellows of his coloring were beautiful, and if I didn't know how delicious ~~the~~ dolphin fish are to eat, I would have felt sorry for the 3½ foot beauty strung up by his tail dripping blood from his mouth onto the wet steel deck.

A new dredge is coming up out of the hold, and we will try again in this same spot. It is just north of Tillanchong Island where Roddo says serpentines have been reported. We hope for better luck in our gamble this trip.

This trip we won. We'd gotten back to the spot and the new dredge was started down at 11:10 AM. in 520 fms. We had 3626 ft of cable out by 11:32 and the bottom had shoaled to ~~460~~ 460 fms. There were good tugs, but then I fell asleep before it came in. I'd had only a couple of hours sleep ~~and~~ in the last 40 hours, and had been up since 1:15 AM trying to get this sample. Now that it was coming in with - I felt - samples inside, I just corked.

There were samples too, when I got up at 2:30 PM. There was one big chunk of ~~basalt~~ basalt(?) plus many pieces of a poorly indurated foraminiferal shale, the latter had evidently been ~~roll~~ rolled around - either on the bottom or perhaps in the dredge - for the corners were well rounded. Rodolfo bottled separately a whole batch of forams that filled a worm boring in the older material. It will be fun to see how the older material's environment compares with the modern.

The GEP went over as the dredge came aboard, and we steamed off at 4½ kts for the next dredge site. This one is just on the crest of the Andaman - Nicobar ridge and only a few miles north of Car ~~Nic~~ Nicobar Island. It was from the bay on the north side of Car ~~Nic~~ Nicobar that Schweger obtained a sample ~~for~~ during the Austrian NOVARA expedition during the last century. From this sample many new species of forams were described, but the holotypes have long since disappeared. We'd like a good sample from here.

When we approached the top in about 20 fms, it was quite a smooth bottom and certainly no place

to try a dredge haul. I decided to try the Shipek bear trap just to see what the bottom was. Then we'd go on west down the other slope looking for a good dredge site.

This trip it was the oil-filled tube carrying the GEP's hydrophones that fouled on recovery. It was hung under the counter on the rudder. After some meneuvering, it came loose, but by then there was a hole about 2 inches long on the hose, and some of the oil used for flotation had been lost. We held a conference with Reggie, Lindberg, and the Captain and found it would probably be about 3 AM before it was repaired with epoxy, the air "walked out" of the hose, and more diesel fuel put on.

Knowing we would have time to dredge and then go back to the top of the ridge to resume our GEP line, we continued on down the west slope of the ridge looking for a good spot to dredge.

We found one too, but it was all after midnight, so falls into tomorrow's summary.

13 April, 1964 NW of Car Nicobar

It is just 10:30 AM, and I am just up from a sweaty 7½ hours of sleep. Sleep isn't able somehow to "knit up the ravled sleeve of care" aboard. I tumbled into the sack a bit after 3:30 this morning and must have awakened 6 or 8 times as the puddles of sweat filled various depressions on my person, overflowed, and ran down my side to bring me suddenly awake slopping at the "bug" that was crawling down my side. Once asleep it seemed only minutes before ~~when~~ I was awakened for breakfast, and the decision to skip it to sleep seemed difficult to make - out of all proportion to its importance. Once up, a shower didn't help much. My clothes are all so full of salt - the ocean's and mine - that they are constantly damp. It will be nice to be dry again.

At 7 minutes after midnight last night, we were underway on 295° headed off the crest of the ridge on which sits Car Nicobar. It started down gently, but then steepened precipitously, and I knew we had a good dredge spot. At 12:55 AM we stopped in 305 fms at the foot of the scarp and by 1:07 the big rock dredge had been swung outboard by Peco and his boys. Sweatt was on the big winch console. He was married two weeks before we sailed, had 4 days with his teen-aged wife, and faces a hitch in the army on his return. His full blond beard started in Singapore is now in the itchy stage and he scratched it throughout the lowering of the dredge. Lt Troy Moses - the only officer aboard who was also on the Explorer during our 1960 expedition - had the headphones for talking to the bridge, and Weller and

Rodolfo were both with us on the boat deck at the console. It was tricky dredging, for the wind had picked up and kept blowing us to the west or down-slope. Most of the run was made with 1/3 sternway on, and we started hauling in at 2:20 AM. There had been only a few and relatively small tugs just after 2:10, but as the big winch started slowly to haul in, there were some more. We were on bottom and hopefully had something. By 3:10 AM the dredge had broken the surface, and as it came up twisting lazily into the pool of light from the two big lights hanging from the top of the bow gallows frame, we could see that we had a good sample.

The dredge was lowered to the deck, the hook was transferred to the bottom of the chain bag, a few turns were taken around the capstan, and the bottom was lifted to spill our samples out onto the deck. There was one well-rounded block cobble that is obviously igneous material. It had a good ring when dropped on the deck. There were big chunks - up to a foot across - of moderately indurated and layered sandy-silt (almost shale), and several harder pieces of sedimentary material that appear to be indurated globigerina ooze. We were immediately underway back to put over the SEP and to continue that line out to deeper water where we will core and thermoprobe late tonight. Don't know why all these things keep happening at night - just another manifestation of the law of inanimate objects, I guess.

The SEP worked well last

night and this morning. I had a good chat with Harbison about it, and he feels that the records are good. I can see some trends below the bottom, ~~&~~ but they seem to me to be open to a good deal of subjective interpretation. Peggy tells me that the magnetic tapes which - in addition to the visual record - has been on all the time, can be fed into a stack of filters back home, the "noise" removed, and a visual record made even where we now can see none through the clutter of extraneous ~~signal~~ returns.

The gravity meter continues to work well. The magnetometer was out for a while yesterday - a leak in the cable - but the reserve cable and fish are in, and it seems to be OK. The weather, believe, releases are continuing on a routine basis, and the biological program of vertical tow for productivity studies just after sunrise, IIOE standard ~~net~~ vertical net haul from 200 m at 8 PM every night, and the 1/2 hour horizontal tow for BCF every evening all continue with only occasional cancellations because of GEP'ing or some other operation precluding the stop for a tow.

It is now 2:40 PM, and I have just had an hour's session with Captain Brown. He would like to have the Calcutta-to-Colombo leg all planned before we get to Calcutta on the 25th. He would like to know where we will dredge the walls of the Ganges Canyon, where will the well-controlled hydrographic survey be run, where and when will we use the box corer, GEP, deep-sea camera, and corer. I am

completely sympathetic with his desire to have the whole leg planned in advance, but since we don't have any idea where the canyon goes after it leaves the "Swatch of No Ground," where the walls are dredgeable, where the bottom may be wide enough to photograph, etc., we can hardly plan where we will be able to do what. This "play-it-by-ear" concept is really all we can do this far in advance, and this is a difficult concept to get across. I will break out the chart of the head of the Ganges Canyon (Swatch-of-No-Ground) that Shepard sent and will lay out a first day's work in the one area where we do know what the canyon is like.

There will be quite a shift in personnel at Calcutta. We gain F.P. Shepard of Scripps, R.S. Dietz of the C&GS, Sam Bush of the C&GS, Col. M.L. Moshla and Sabbat Rau of India, plus one Ceylonese scientist - name unknown. We lose Bob Burns, Geo Peter, Geo Meller, Sarma and Borglund, ~~and~~ Ong ~~We lose~~, and John Lindberg from ~~Rayflex~~ Rayflex. We lose seven and gain six, so it will still be crowded aboard.

Somebody on one of the fathometer watches has a real "thing" about putting the PDR on 6-ping instead of on continuous ping. Six-ping is fine when the bottom return merges with the outgoing ping, but otherwise it gives a much poorer trace. About 4:15 PM today (1247 GMT) it had been on continuous ping for a long time and we had a fine trace which peaked out at 810 fms on top of a good seamount. The

reason I stopped in to check was that at 4:15 we ran through an area of turbulent water that back in the Makassar Straits I would have definitely tied in with a bottom feature. Yet here too – even at 810 fms or 4860 feet – there was a surface expression of this submerged peak.

A good sunset tonight. We are still poking along at GEP speeds of about 4½ knots, and the wind has picked up out of the east. It is still a bit warm, however. It is now 9:30 PM, and I plan to sleep right through the thermoprobe and core station tonight.

14 April 1964 – NW of our Harbor in the eastern Indian Ocean.

I must be getting pretty blasé. While waking up over coffee and a waffle at 7:00 AM, ~~the~~ Kotter rushed through the wardroom with his gunbelt on saying "shark, shark". A minute or so later I heard three "whaps" then two more – all sounded much like the sparker on the GEP. They had hooked the shark and Kotter had put some bullets in its head as they hauled it clear of the water. It was hauled aboard, but ~~the~~ as I headed aft along the starboard rail, I passed a whole string of grinning Chinese and Filippinos heading toward the galley each carrying a fin or a steak or some bloody unrecognizable organ. By the time I got to the fantail, there was nothing to be seen but a shark's

jaws twisting lazily on a line suspended from the overhead awning and one man washing a big brown stain off the deck. And I thought ~~piranhas~~ pirrana fish were fast!, the Pioneers mess force has them beaten hands down.

At 1117 PM (1747 GMT) we stopped and by 1138 the prayer was over and the deep cast was underway. Messenger time was 38 minutes after midnight for the deep one and at 0217 this morning for the shallow one. Then Burns' thermoprobe was over in 1900 fms at 0308 AM and back aboard at 4:30. It didn't trip, but it did penetrate. Bob is still soaked out, so I'll have to wait to see how he made out. Core #20 was over at 5:50 and back aboard at 8:19, and we were underway on course 098° at 8:24. On this run east across the Andaman Ridge, the GEP is aboard and we are running over 235 RPM for a welcome change.

That core (#20) was about 11 feet of fine silty clay. There were, however, some gaps in it as though the piston had intermittently sucked water. Don't know what does this.

Mel Fields of the Weather Bureau reported this morning that his five millivolt reference unit for his pyrheliometers went out, and he feels the Eppley pyrheliometer is not functioning well either. I have told Cole & the Capt, and Mr. Mother is being asked to work these over. These are all part of the automatic weather station Dr. Wolle of Univ. of Michigan put aboard. Fields feels that the same gear on Atlantis II of Woods Hole has been totally inoperative except for what has been put on manually, so it

behooves us even more to get this one operating well. Since the JEP cables became fouled twice in a row, we tried this morning keeping a bit of way on, and we had no trouble. This will now be our standard procedure.

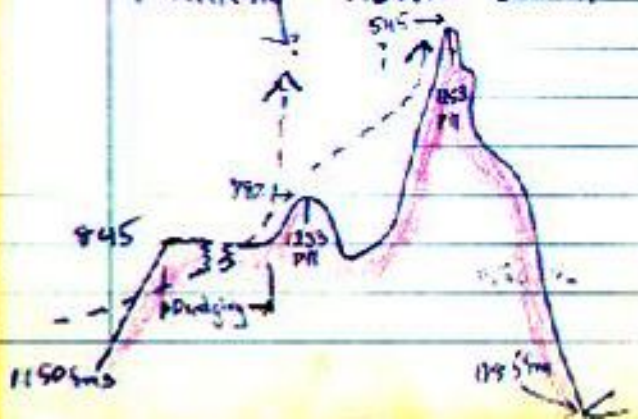
It is now 10:00 AM, and if the bottom acts as predicted, we will be on station for the next dredge in about a half hour. This one is in about 1006 fms on the west side of the Andaman-Nicobar Ridge southwest of the southern tip of Little Andaman Island.

Our DR estimate of this dredge position is 10°04'N, 91°40'E. It is now 1230 PM, the dredge which went over at 1029 AM in 840 fathoms, started in at 1140 with 6200 feet of cable out, and came aboard at 1220. The sample is small but adequate. There were four or five small chunks of what appears to be indurated foraminiferal ooze. Rodolfo wanted to keep it all for his work at USC, but I told him that a cut of each of these hauls must have the CdGS label on it. We are delighted to have him aboard, but even if we had never heard of USC, we would still be doing just about what we are doing, and we will damn well have some samples of our own to get worked up. I think the point got across.

In the core and dredge book that Meller & Rodolfo have been keeping, they did not log the lost dredge of the 12th of April as #7, but called the following one (#8 in the ship's records) #7. I have talked to Meller about this and feel that confusion will

reign supreme if the numbers on their book do not square with the ship's records. He has now made their #7 into #8, their former #8 into #9, and this last one they have now listed as #10, so it is all straightened out. They will add a page to their record showing that dredge #7 was lost.

As we left that dredge station feeling that we really had not altered ~~altered~~ to ocean's topography to the extent that the charts need be redrawn, we almost immediately crossed a narrow zone of white caps and turbulent water of perhaps a half mile in length running north-south.



This was directly over the 782 fm top of the steep scarp up which we had just dredged. A second batch of such water came up 20 minutes later (0723 SMT) above the 545 fm crest of the whole seamount. I still find it hard to believe that features 5070 ft below the surface can have an effect on the surface, but we've seen and documented it over and over since Singapore.

(#21)

We stopped for a core and a thermoprobe in late afternoon. The core was OK – about 6 ft of fine-to-medium sand from a depth of 610 fms in a small basin south of Little Andaman at 10°04'N, 92°26'E. The thermoprobe – the light-weight version – was being lifted over when the rig parted between the two weights. The recorder and one weight went one way still secured to the

cable, the probe and other weight were headed for the deep six. Someone had a holding line on it and just hung on, and it was recovered. "I'm no hero," he said, "as soon as my feet had started to lift up off the deck, I'd a let go." At any rate the wires from the probes to the recorder pulled the plugs in the recorder and sheared the batch of them. Scratch one recorder!

Burns has cancelled the next thermoprobe lowering while they get the spare unit checked out and the original larger probe rigged to go tomorrow. It will go out over the bow, and that station is the basin where the Serrano got the weird temperatures and where Burns is most anxious to do a probe lowering.

At 10:14 PM we stopped to take another core at 10°04'N, 95°15'E where we had originally planned a core and thermoprobe. The slope had been pretty steep, dropping from 500 fms to 1525 fms in about 15 minutes (at 19 RPM). It was a toss-up whether to core or dredge. Since we had dredged in clay in the past, we decided to core here - slope or no slope. Lavery bet Rodolfo a beer at Calcutta that he'd get no core - and lost. There were about four feet of the stiffest clay I have ever seen. The core catcher had to be put in a vice and the clay plug forced out by two people. It then stood solidly by itself - more like stiff taffy than sediment. This was core # 22.

Then on to the east and the thermoprobe station in the basin south of Invisible Bank.

15 April 1964 SE of Little Andaman I.

There was some considerable jockeying early this morning trying to get into the basin at 10°N, 94°E. where we crossed it, it was less than a mile wide, ~~so we~~ but those on the bridge stopped where the spot had been put on the chart - not realizing that it was the basin - not the DR spot - that we were after. Barbee was awakened and we moved back. At 5:48 AM the station was started. It is to be a deep cast, shallow cast, then a special deep-bottle cast, core, and thermoprobe. The depth was 2225 fms when we stopped and seems to be staying fairly constant.

At 0900 Barbee, Moses, and I had a planning session down in the nicely air-conditioned plotting room. We hope now to dive on Invisible Bank, ~~shoal~~ the day after tomorrow and will take black & white and color motion pictures. We will also plan ~~a~~ ~~boat~~ boat-over-at-sunset so the UN boys and Hale can get some footage they have been after for some time.

The great East-West legs I had laid out across the Bay of Bengal to run between the Irrawaddi Delta and the mouth of the Houghley River had been planned back in Washington as the "sponge". These could be run if we had time, shortened if we had only part time, or omitted completely if we were running out of time. It now looks as though we'll get to Preparis Island at the ~~Nor~~ northwest corner of the Andaman Sea and the end of our long east-to-west ~~E~~ GEP line with something like 44 hours over and above the required running time

to pick up our river pilot for the junk-nudging, bank-rubbing, sampan-scraping, twisting, turning slow run up the crowded river to Calcutta. I'd rather use the time in this area where we have concentrated so much effort than in the open Bay of Bengal where we will be for three weeks in May anyway.

Yesterday I would consider as having been a day off for me, except that I don't know quite what it was a day off from. I spent three hours up on the flying bridge strapped to my shorts reading Vladimir Nabokov's "Life Fire" — a hilarious utterly delightful commentary on the pseudo-scolasticism of so many small colleges. His use of words is great. Then a movie in the evening — corny British film but with one magnificently proportioned female that set the whole ship on edge. The films should be screened more carefully — no pun intended — for showing on female-less ships this far from port! Then I put in a full 8 hours of sleep — with, of course, the usual number of "sweat-bugs" waking me from time to time.

The core (#23) created something of a problem. We had hoped to cast, core, and thermoprobe in the deep (2200 fms) basin, but by the time the big piston corer with pinger above had started down from the bow at 1245 AM the bottom had shoaled to 1898 fms. We might have meandered slowly back into the flat portion, but we had the buoy and bottles out on another in-situ productivity run. We wanted the core and

the probe in the same area, and we also wanted a core in the very bottom of that basin. We decided to get our core here and see what it was like, go back to mid-basin for the thermoprobe, and then core it again if need be. We watched the crazy-plaid pattern on the PDR and brought in 14 feet of core - some possible suckling in. This gave a 2 to 3 foot section of water in mid-core. I'd like to see some good studies of ~~cor~~ piston corers in action to see just what does happen down there.

The ship steamed east into the basin again. The big probe went over from the boat deck and forward where the big EG&G pinger was put on at 150 fms (900 feet) above the probe. With ~~out~~ only about a quarter of the cable let out, the pinger quit dead and our crazy-plaid became white muslin! In a hurried conference in my room Barber, Burns, & I decided to go on down pingerless. The wire angle was zero at the surface, the bottom was soft, and 1000 extra feet should insure penetration and no tension for the 5 minutes the probe had to stay in the bottom. The pinger was aboard by 7:45 PM (a small leak had put water into the transducer). The probe was up shortly thereafter, and I went back with Burns to the photo lab to wait the 15 minutes it took him to develop his film. We knew from the mud on the probe that penetration had been to the hilt, and as Bob unrolled the film from the developer rack we could both see the series of dashes that meant that two of his

3 probes had worked well.

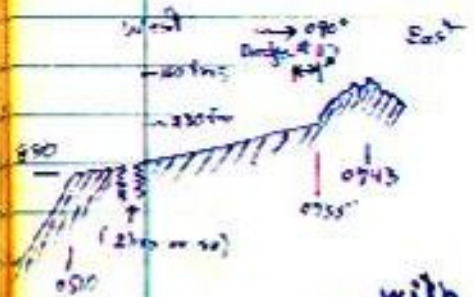
It is now 8:30 PM. The Doc (cutting-type Doctor) is on the floor in Larsen's room putting folk music from Larsen's tape recorder onto bits, I've just had two glasses of cranberry juice, Rodolfo & Heller are playing chess, Ens Jones is sound asleep on the couch dripping wet, and the Pioneers moving on east at 16 knots to the next station.

Having the pinger functioning saves us lots of wire! Between the pinger and the thermoprobe on that lowering were some 900 feet of chinese rope tricks, boy scout knots, and cats cradles & our main cable is now a neat 900 feet shorter.

16 April, 1964 - off the Burma-Thailand border

At 7:38 this morning, timed nicely to ~~coincide~~ coincide with the dousing of my second cup of after-egg coffee, we slowed to 1/3 speed. ~~Just~~ This trip the spot marked on the chart and the feature we wanted to dredge were the exact same spot. It was one of those knolls ~~[illegible]~~ above the break in slope like those we passed over between Singapore and Penang. About 4:30 this morning the depth was 1335 fms as we headed east toward Burma across the Andaman Sea. Twenty minutes later the bottom started a long smooth even rise culminating in a marked break in slope at 580 fms. It then continued up at a fairly even rate until 7:35 when at 232 fms there was a sudden rise, the irregular trace on the PDR that means rock

bottom, and eight minutes later it peaked out at 160 fms and started down again. We turned back to 270° and eased back up and over and back down to about 230 fms to dredge upslope. Dredge No. 11 went over at 0806, and at 815 with just 1800 feet of cable out ~~over~~ in 242 fms of water (1452 feet) we had a good bite. We went on down to 2000 feet of cable and had regular and good bites until 08:31 when we started it in. There were more hang-ups, a few tense moments – that system must have a dynamometer in it for our work off San Francisco this fall – several good final jerks, and a mounting feeling that we had a good load. By 9:17 M it was all aboard, but all we had were a dozen or so small chunks – apparently broken



off the outcrop – but no one bigger than a few inches across. They were black vesicular lava possibly basalt. My own feeling is that this NE-SW trend of the shelf break is a long fault area and that these volcanic peaks we've crossed along the break represent fissure lavas that have come up along the fault. Dredge #11 was at 10°04'N, 95°23'E

As we were dredging, George Peter came up to the winch to say that we had a good magnetic indication here of rock at the surface. He was getting the sharp 100-gamma jagged magnetic record ~~[illegible]~~ rather than the slow changes of deeper material.

It is now 10:30 AM, and we are back on 090° headed toward St. Matthew Island on the Burma coast where we change to 283° and make the long run back

Bank

across Invisible ~~Shoal~~ until we can make a navigational fix with one of the Andamans.

17 April 1964 - Invisible Bank off the Andaman Islands -

The long run last night was a good one except that some clod had switched the PDR to its six-ping mode rather than leaving it on continuous ping. This made a much poorer record than we wanted on this run - none of it until I got up there at 0730 can be used directly in any publication. I thought I had mentioned this and carefully explained the whys to all the QMS watchstanders and the Electronics people, but obviously my message hadn't gotten through. I was annoyed and spoke to the Captain. He agreed completely and there is now a note taped to both PDR's directing them to be left on continuous except where 6-ping may be necessary to get a

record through the outgoing ping, noise, DSL, etc. I hope that will do it! It's too bad to have anything less than the best we can get.

On the long run west from St. Matthew's Island off the Burma coast to Cinque I. off the southern ~~tipe~~ tip of Little Andaman I., we crossed the whole complex: shallow shelf, fissure lanes (?), break in slope, long slope, sharp scarp, deep (2000 fm) basin floor - but here with a vee-valley at the bottom then the abrupt rise up onto Invisible Bank. It was a very steep rise topping out on this crossing at 40 fms at 8:35 this morning.

Now at 10:05 AM it looks as though we would make our land fix and get back to Invisible Bank about 2 PM for a dive to collect samples and to get still and ~~under~~ motion pictures underwater. We'll shoot up the roll of color in the CCAS. Bell & Howell then come up to the launch while B. Hale puts in a 100-ft roll of black and white we can shoot up for the UN boys. There is a ~~rock~~ chart notation of "rock awash at High Water" on the bank, and we expect to anchor north of this ~~at~~ in about 9 or 10 fms.

When we are through, we will probably put out the launch so the photographers can get the footage of the ship underway which they have been agitating for. We'll dredge and then scoot down south to about 9°57'N for another core and thermoprobe try in the 2200-fm basin where we worked 15 April.

A bit after 9 AM we saw eight sperm whales that

surfaced right off our bow. We were doing nearly 17 knots and were into them before we or they could do anything about it. They scattered, but we apparently hit one, for I could see a trail of blood from one as he slid by a couple of feet off the hull. They sounded almost immediately and within seconds of our first sighting them, they were gone, and the surface of the sea was calm again except for the occasional flying fish that breaks the surface and glides along to fall back in.

We picked up a good band of turbulent water along the east but not the west edge of Invisible Bank, so it isn't so invisible after all.

At 11:20 we had a good set of positions from Cinque Island and came right to 092° headed back to Invisible Bank and our dive site. Dick Stephen-Hassard talked to the Captain who OK'd his going with us to work at the surface. Tanks and gear are now in launch No. 4, and I'll get a crowbar and line so that we can have a better chance of recovering some museum specimen corals if we locate some.

Since George Peter has been keeping a geophysical log, I have not bothered to include much here of a purely geophysical nature. As I come in to switch to my scroungiest shorts for the dive, I found he had left on my desk his latest topography - magnetics - gravity profile. It covers the run all the way across from St. Matthew to Cinque I. Approaching Invisible Bank, the gravity increased from an average

value of about 5975 milligals. So the whole run, up to 6075 over the bank, and down to a low of just under 5850 in the area just west of the bank - an anomaly of 225 milligals, related to the bank. There was a magnetic anomaly of about 100 gammas, but this was about on a par with others to the east as we approached the bank, and with the ones we crossed last night up on the shelf off Burma.

It was nearly 2PM by the time we had gained the top of Invisible Bank again. This trip it was far from being invisible, for a good swell was running, and great white breakers formed, crested, and rolled off of the rock awash. The sea was like glass as the Pioneer coasted into her anchoring position in 9-10 fms. The hook went down, and

No. 4 launch was swung out, Lt Jg Dohrman, Cecil Sweatt at the wheel, Ashley ~~Dagum~~ at the engine, and Pedilla the big capable dark Hawaiian ~~negro~~ as crew, Ens. Paul Larsen, GMS Dick Rogers and I as divers, Dick Stephen-Hassard as surface man, and Hale, Borglund, and Sarma as the Camera dept. We headed off toward the south into what we hoped would be shallower water, as there was a goodly current at the surface. It was planned that Hale and Borglund would shoot Larsen & me jumping in while Rogers got it from below with the Bureau's Bell & Howell in the Sampson case. All was set, everyone ready, and in we jumped. Later Rogers said he hadn't realized how hard the trigger was to squeeze and had gotten nothing. We climbed back aboard in all that heavy gear so he could get it this time. He thought it

was off, and he shot up the rest of the roll underwater. On returning, Hale discovered that Rogers had shot the whole role wide open and it would all be about 4 stops overexposed. He had evidently horsed the f-stop lever, and it had jumped the control band. Next dive, I took it down. The trigger worked perfectly alright, and the f-stop lever worked OK. We'll wait to see the results. This dive was a considerable disappointment after Seahorse Shoal. Although the water looked clear from the ship and was clear in the top 30 or so feet, ~~but~~ below a very sharp thermocline at about 30 feet the water was quite turbid with very very minute suspended material limiting visibility to a smokey 40-50 feet. This would be good for the U.S. East coast or California, but for the Andaman Sea it was not.

There was no luxurious coral growth here - only occasional solitary forms. The bottom was paved with algal balls and broken algal material. The balls averaged between golf and baseball size. I brought back several in the left pocket of my shorts. The right pocket I filled with the coarse calcareous sand that lay beneath the surface. Occasionally the even tennis-ball pattern of the bottom was broken by a short straight line. I knocked off a piece of this, and it ~~appeared~~ was sedimentary beyond a doubt. It looked like a dark limestone or perhaps a highly calcareous siltstone.

We moved back nearer the Pioneer to see if the bottom was more interesting there. It wasn't, but the fish were. There were schools of small yellow-fin tuna, red snapper, many and

1. working up data –
2. practical aspects of it for layman –
3. uniqueness of simplicity [illegible] –
4. [illegible] of [illegible] – [illegible]
5. I.O. [illegible] lab.
6. [illegible] discipline in some ship – [illegible]
7. wild predictions for future –

SARMA (Apt S.D.) 236. East 36th St. N.Y. 16 (Wimbledon Tavern)

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CDR Navayan N. Sathaye
CDR Raghuvir Y. Tambe
Hooghly River Survey
% Port Commissioners
15 Strand Rd.
Calcutta 1

Residences – A/5 & A/6 Nimak Mahal Road
Kidderpore,
Calcutta 43

Ná ma stě – ji – (gtay)
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base of the arms. It has been pickled and will be identified later. (Dive Sta #2)

The ~~dredge~~ dive site was at 11° 11.3' N, 93° 31.6' E, and the ship left at 4:58 PM on course 060° to dredge on the eastern edge of the bank. This is dredge #12 at 5:35 PM in 100 to 300 fathoms of water at 11°14' N, 93° 34'. The haul was small, more chunks of sediment, a long skinny fish, and a few brittle stars. We then headed out on 145° looking for a core and Thermoprobe site. At a depth of 149 fms the bottom ~~[illegible]~~ leveled out a bit & the big corer was put over. By 1015 it was aboard with 17 feet of core and a 17-foot barrel smear. Clayey sand and silt, and the trigger core showed distinct layering. Now at 11:45 PM the big thermoprobe is on the way down and I'm on the way to bed.

18 April, 1964 Over "the hole" SE of Little Andaman I.

The thermoprobe last night was a good one with all four probes putting a record on the film. There was lots of mud on the upper part of the unit, so it is quite probable that even the top probe — usually in the water — was also in the sediment.

We left there (11°01' N, 93°42' E) (Core #24) at 2 AM on course 168° for another crack at "the hole" where we had only moderate luck before. At 8:25 this morning the corer went down in 2015 fms with the pinger above it. Back aboard at 10:15 it was ~~aboard~~ a full 20-foot core of fine silty clay — just what Rodolfo wanted to take a look at the rate of sedimentation. We'd gotten out of "the hole" by the time the corer was up, so we backed

back

and filled to get, ~~[illegible]~~ to 2200 fms. The big probe went over at the bow with the pinger 900 feet above at 11:30 in 2015 fms. (Core at 09°51', 95°57')

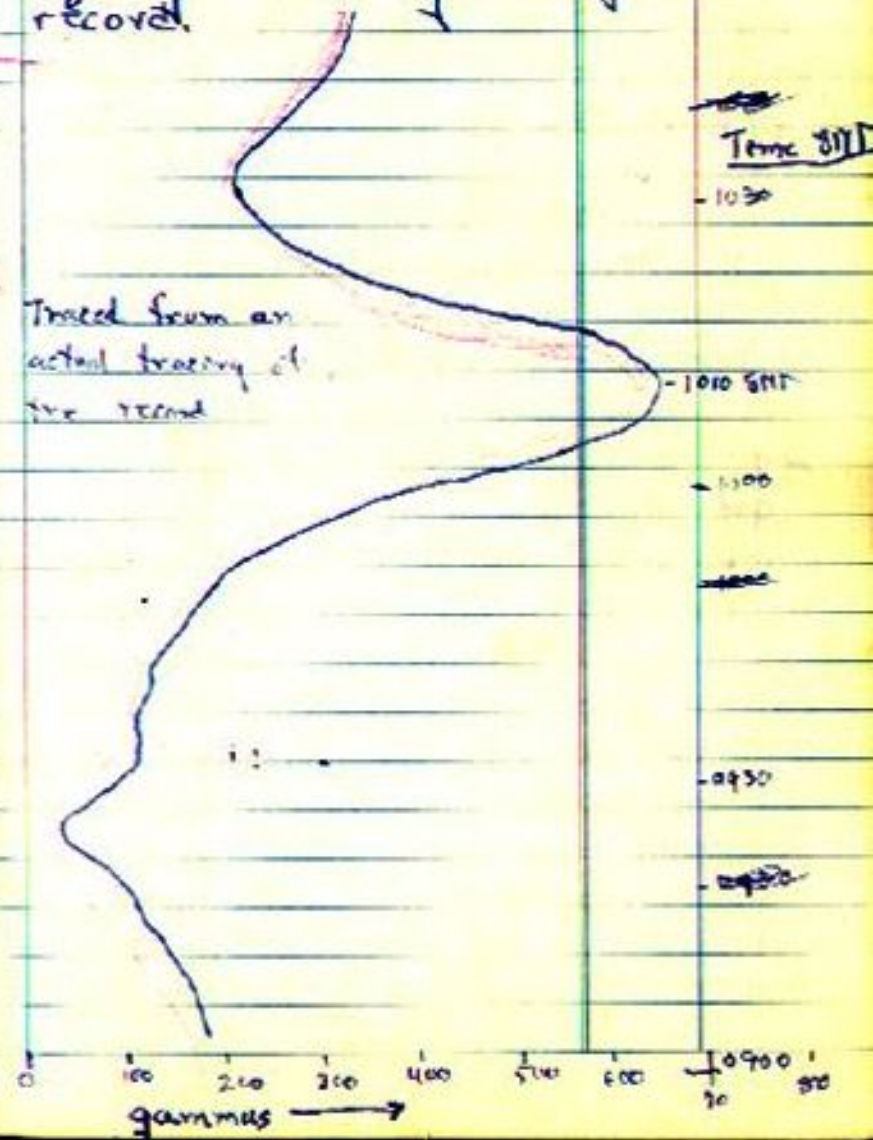
About noon on the port wing of the bridge, I was almost hit by a bird coming in kamakaze style. He was pooped and just stood up against the bulkhead catching his breath – or whatever pooped birds do. Parrot green back, brilliant electric blue wings when folded, white neck band, black mask across his eyes with long brown "eyebrows", flat head and russet red breast. You had the feeling that his tail was too short – as though he should have long tail feathers but didn't. He flew around the ship for a while then landed on the big cable between the tension device and the gallows frame and since the cable was running out at the time, he was carried forward toward the block. He saw it coming and flew off in an uncontrolled way, went into a loose spiral and into the water.

He obviously was not a water bird and slowly drifted off. He evidently survived, for at dinner this evening Hale asked me if I had seen the bird they caught and had in a cage aft. As he described

the coloration, I knew it was the same type — having seen the sharks, I prefer to think it is the same bird.

The Thermoprobe was a bust! All gear recovered, good penetration, film motor worked OK, but — as Burns put it — "Idiot me, I didn't turn on the power for the bridge circuit" These things can happen and he feels so badly about it no one has needled him on it at all. His chess game tonight was not as good as usual.

We were underway from what we have come to call
* "the hole" at 2:08 PM on course
* 017° headed for the start of the GEP run across this Invisible Bank — Barren I — Narcondam I. ridge. As we ran up the "range" to the eastern end of the GEP line, we were getting mad bottom topography and an equally exciting magnetic record.



The biggest bump came at 3:40 PM (1010 GMT) with a rise of nearly 700 gammas - an exceptional anomaly.

The SEP was in the water at 1140 PM, and when I went to bed at midnight, John Lindbergh and Austin Weeks were working on the recorder trying to get a record. This equipment is far from operational!!

19 April, 1964 - On SEP run post Barren Island

This SEP run started at 11° 42' N, 94° 33' DR just before today started, and the line was under way on course 286°. During the early morning they got good records on the SEP. At one point their penetration was as much as one second giving about 5000 feet estimated penetration. As we came up onto the ridge, the sediments showed up nicely, thinned out and essentially disappeared over the top, and now - at 9:30 AM - are coming in again as we work down the west side.

Vic Alvarez is complaining again about garbage in the early morning plankton tows. Their vertical tow comes just as the cooks are preparing morning chow, and there is a steady rain of garbage over the side. It fouls up their

samples badly – as does the flushing of heads all over the ship. The new ships, Oceanographer and Discoverer will have one clean side with no discharges whatsoever, but this isn't the Oceanographer. I talked to Barbee and I think he is being quite unreasonable about it. He claims that there is nothing more they can do to stop it. They do pass the word over the speaker system, but the cooks don't understand or don't heed the announcement. Still the garbage goes over. I, on the other hand, claim that if the Pioneer has reached the stage where we can't stop for ½ hour the throwing over of garbage, we shouldn't be out here in the first place. I'll get it stopped if I have to go down at ASDUAH and stop it myself. It's the old problem of my being aboard as an "adviser" or "suggester" with implied responsibility but no authority. I hate to have to run to the Captain with things like this – as I did with the 6-ping vs. continuous ping when I could do no more – but sometimes that's the only way. He is most reasonable and understanding and always cooperative. The "adviser" relationship with him works exceedingly well. It is unfortunate that the same spirit does not filter all the way down.

We were in fairly close to Henry Lawrence Island when at 1220 PM we made our turn in 53 fms of the western end of the GEP line at 12°07'N, 93°10'E. There was too much noise in the magnetometer this morning – about 8:00 – to get a good signal. It developed that there was a bit of water in the fish. A new one is now on, and it seems to be off, but

it's too bad to miss out on even part of that GEP line.

Somehow this record seems to be recording primarily the problems. The things that go along smoothly like the gravity meter, plankton tows, balloon releases, etc. don't seem to rate much mention. The trip is not, I am sure, as bad as it must sound.

We stopped at 3:34 this afternoon to put out launch No. 4 so Hale and the UW team could get their underway ~~and~~ at sunset shots. We'd hoped to do it yesterday, but it was too close to sunset when our dives were over. Into the launch piled Hale, Borglund, Sarma, LtJG Hotter & the same boat crew as yesterday. We made several runs for them. One full speed with a destroyer type turn - just as dinner was being served!. They did a sunset shot of the ship steaming along all lit up like a Christmas tree with the sparker of the GEP flashing every 4 seconds. We even managed to arrange a colorful sunset for them. I've just talked to Ramakantha Sarma, and he feels they got some good footage. I tipped him off to expect some static from Chief Ulrich. It seems that the photographers - harking back to the days of coal burners - thought the pictures would look better with a good plume of smoke pouring from the Pioneer's stack. Diesels smoke only when the engine room is doing a bum job and they have a poor air-fuel mixture. A smokey ship means a dopey chief! Somebody on the bridge got the message from the launch and

passed the word to the engine room to make some smoke. Ralph Uhrich was up in seconds to find out who had passed the word that would look into permanent celluloid for the great amusement of all other Chief Engineers the impression that he didn't know his business. The photographers didn't get any smoke other than what they might have seen coming out of Ralph's ears.

The launch was back aboard at 6:32, and we moved off on 148 to the planned probe and core site. We put over the probe at 8:25 PM and it was back at 9:51 with a good mud smear on it. At first Burns thought the record showed that it had pulled out of the bottom almost on contact, but he studied his film more carefully later and decided it was a pretty good record after all.

Rather than core here where the bottom now was coming up and where — from the thermoprobe liner — we already had a good core, we decided to go on and dredge the peak we were coming up on. It rose from a depth of 1250 fms up to 62 fms before we turned back and moved down to 120 fms to dredge. At 11:57 PM we put the dredge over, and by then we were down to 234 fms. We put out a total of 2000 ft of cable but had to do a good deal of backing down to keep from drifting down slope and ease our way up — hopefully to drag the great steel and chain bag up the slope below us. We had some good tugs and started hauling in at 27 minutes after midnight.

20 April, 1964 - East of the Andamans

We were dredging when today started. It was a beautiful night with a quarter moon hung at a crazy angle and spreading a long shimmering silver carpet straight to the Pioneer. Standing at the console of the big winch, up on the boat deck, the world consisted only of that moon, its silver wake, and the triangle of lighted bow surrounded by the soft black velvet of night. An interesting illusion of a ~~rocking~~ gently rocking slightly drunken moon was caused by having no stable reference — no horizon. The triangle of light and I appeared rock solid while it was the moon that rocked gently with the swell.

At just 1:00 AM the men at the bow yelled "sight", then "surface", and the wet and shiney chain dredge turned lazily half in and half out of the water. Helvin turned up toward the boat deck and gave the "we got some" sign and immediately turned back as though he thought it would all sink back into the water.

It was a good haul of several large chunks and one big slab of what probably will turn out to be a tuffaceous sandstone. There were several sponges of the venus flower basket type (euplectella?), and the whole load was laced with long sponge spicules looking liked strands of fiber glass and just as sharp. The location of this haul and of the deep sea camera station immediately afterwords was 11°48'N, 93° 36' E.

The big camera had been all

gone over by Bittale earlier and was ready to go. The deck force led aft the end of the deep-sea cable to the boat deck aft where the big crane was lifting the silver and yellow camera rig clear of the rail. It swung out into the night with its compass and vane gyrating madly on their chain hanging below the frame. The pinger on the frame gave out its regular "queep", the cable was hooked on, and the camera was lowered into the black sea at 1:25 AM.

I went with Byron up into the chart room to set up the oscillascope on which we can watch the pinger's pings and to get made up the headphones and mike with which Hale and the winch operator keep in touch. The bottom was at 240 fms when he started the lowering, but this was a fairly steep slope, and as the bottom kept getting deeper, more cable was let out to keep the camera about 15 feet above the bottom. Using the PDR and the 'scope and a direct wire to the winchman, the whole operation is run from the comfortable chair and air-conditioned comfort of the chart room — a rough way to work at sea!

Sometime around 2:30 I came down to the wardroom for a cup of coffee, made the mistake of lying down "for just a minute", and we were through and underway when I woke about 4:30 cramped and dripping with sweat to stagger aft to bed. I slept through breakfast and now at 10 AM we are on our next to last station before the final GEP line of this

leg.

The other day LtSG Dohrman and QMS Woods had the big signal lights, which are mounted on opposite wings of the bridge, pointed aft at the stack and were practicing morse code. I couldn't read a word of it, and it annoyed me. Yesterday I talked to Wolff in the radio shack, and last night while we were dredging he gave me a list he had typed giving all the letters from A (·—) to Z (——··). I worked at it over coffee this morning, and I'll have it before I leave at Colombo if it kills me.

The camera was back aboard at 4:30 AM, and we were under way on course 024° for our last big station - cast, core, heat probe, in situ productivity station, and two swim calls.

We stopped at 9:04 AM and ran a deep cast (10:00 messenger time) and a shallow cast (11:10 messenger time). At 12:05 PM the big piston corer with the pinger above it started down in fms. This is Core # and the last one planned for this leg. There was a full 14½ feet of good homogeneous gray silty clay, and Rodolfo seemed contented.

It is now quarter of five, and Burns just stuck his head in to say all four probes had worked and he had a good record from the lowering that immediately followed the core. He also borrowed a Ian Fleming James Bond paperback — Moonraker. His major work is over. He leaves the expedition at Calcutta and is preparing to relax a bit.

This was a long hot station — some seven plus hours. The sun

blazing hot and there was little air stirring above a flat calm sea. The ship just soaked up heat that we'll radiate all night to be ready to soak up another day-full tomorrow. Dr. Spencer - the PHS doctor aboard - had arranged for a swim this morning and one again this afternoon. As soon as it was announced over the PA system, bodies began hurtling off the ship from all levels. A few timid souls worked their way down the cargo net slung over the side and just slithered in. There were all colors of suits - and some no suits - as there were all colors ~~and types~~ of men. The men colors ranged from the pale sickley white of the engine room people and radio operators through all stages of suntan - light pink to the deep brown of the deck force - through the rich copper

of the Filippinos

of the Hawaiians ~~&~~ the café-au-lait and dark brown and the jet black of the negros. There were fins and face-plates, snorkles and underwater cameras, good divers, jumpers and belly-floppers, swimmers and floaters, divers and strugglers, but all seemed to enjoy it. I took a couple of jumps from the main deck - not good dives, but passable - swam a bit, and then went back to the flying bridge and my little sheet with morse code on it.

That day-long station never varied in depth over ten fathoms
* from the 1145 -fm depth where
we stopped this morning. For the
* record it was located at 11°44' N
93°56' E

It is now 5:25 PM, and we are
headed at 235 RPM ~~A~~ on course
* 084° for our last dredge before
Calcutta.

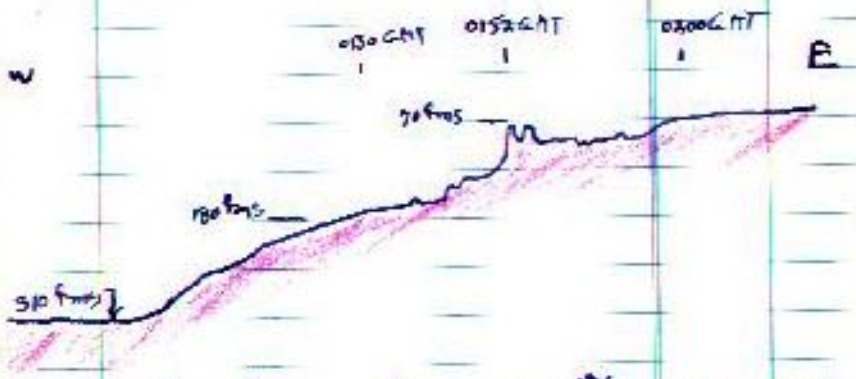
The dredge was over at 8:08PM after a good rise to 270 fms - a bit less than the 344 fms shown on the chart. Instead of dropping back down, however, it leveled off, so we headed back to the steep part to dredge. There were some jugs - only four though - and it was back aboard at 9:40PM. By 9:55, we were under way on course 090° headed back across the Andaman Sea for three ~~dredge~~ snapper samples before we start the long 54-hour GEP run across the front of the Irrawaddy delta.

That dredge haul (#14) was a real jewel. We got about 150 lbs of dense, heavy, solid igneous rock plus a few chunks of what may be a breccia with rounded inclusions. I had B. Hule get a photograph of the haul and marked the largest chunk in orange marker pen for the Bureau.

21 April, 1964 - Off Kabaysa I. Burma

It is now 9:00 AM, and it has been a comfortable night of steaming eastward at about 17 knots. The air scoop in the porthole has - for a change - been scooping air, and I was able to sleep soundly wit none of the usual "sweet buys" to wake me

The run east has gone well so far. I reeled back the PDR



roll from the night run and could see no definite vee-valley to tie in with the one found on the previous run. There were, though several rocky-looking depressions that could have been canyons, but we'll have to wait until we can get these all plotted up.

We held a planning session with Weeks, Hudson, Barbee, and me to see which were the priority projects that still remained. Our time is now overdrawn by about four hours. We must be at the mouth of the Hooghly River by 0400 the 25th to pick up our river pilot and start up on the high tide. The GEP line from east to west is the most important bit left now. We had planned a couple of more snapper samples in close to the Burma coast, but there is already a batch of Serrano samples in there, but there has been no GEP whatsoever through this area. On the basis of this, we decided to knock off

Finally we discussed data processing and working up of the results of the trip, but when I listened to it, it sounded insufferably dull - just awful! We should have stuck to sex.

At 3:30 PM while Cole, Barberg and I were in our daily sessions with the Captain, we slowed to pull in the magfish, the GFP was put out, the magfish streamed, and by 3:50 we were underway on course 277° for our run across the tip of the Irrawaddy delta and the - hopefully - buried volcanics and into the Indian Ocean.

It is now a bit after 10 PM, and the "gepper" is gepping it. It was after 5PM, however, before Lindbergh really got the blasted thing working. I've just been back to the shack, and they are in fact getting a record. It looks as though they are getting about one second penetration which - they feel - should be about 3000 feet. There are several flat-lying layers visible near the top of the record, but the rest appears to my untutored eye to be merely noise. It is quite probable that there merely is no good reflecting layer in the relatively soft delta sediments. Lindbergh tells me that they have had same trouble in the Mississippi delta area, but that the record we are now getting is better than their delta ones back there. I hope we can pick out the volcanics at depth. Time will tell.

Had dinner with the Captain this evening, and if I'd had a clean pair of

shorts and a clean shirt, I would have worn them. I know now not to send my laundry to the ship's laundry. It went out 11 days ago and is still not back. I've been aft several times, and the answer has been always "Tonight for sure, Doc." I'll go back to doing my own.

I've just checked with the SEP again that machine is in the gray area between hocus-pocus and sheer occultism. They look at this gray mass of recorded nutmeg and smile with pride at the success of their black boxes. Maybe there is a record there, and I just do not have the proper polarity to my eyeballs. I am still a non-believer, a SEP infidel, I'm on sonoprobation until they prove to me that it's getting a meaningful record.

22 April, 1964 South of Martapan Bay, Burma

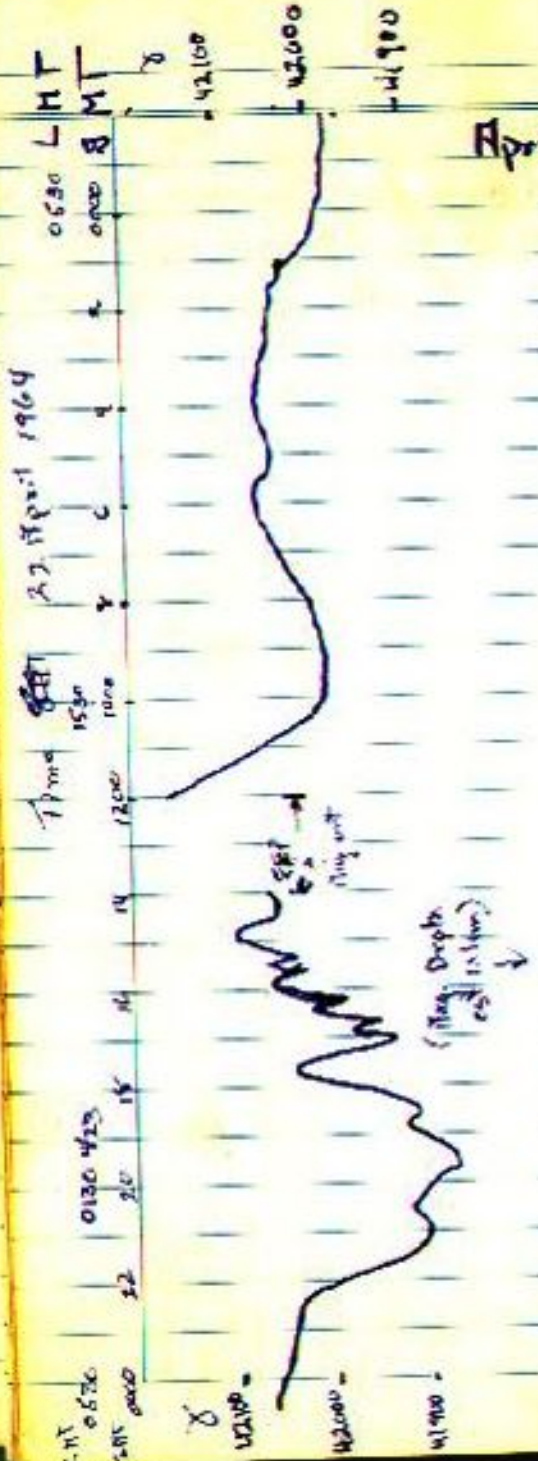
That SEP line is due to run for some 52 hours. The gear worked well - I'm told - all night, but we are still getting flat lying deltaic sediments with little reflecting material at depth.

At 9:00 this morning I was scheduled for a lecture to the crew on what we are doing and why. What with their questions and all it lasted about an hour and a half. They threw no fruit, and no one dozed off that I noticed, so I assume it was alright.

It now looks as though we will wind up this SEP run about 8PM tomorrow night. Carried away in a moment of passion, I offered to stand one of the SEP watches on this long run, and the dogs accepted, so I'll have the midnight to four tonight

One man from the engine room has been in sick bay for three days now. Weeks and Harbison are sleeping on deck, ~~now~~ since they had been quartered in sick bay. Doc Spencer thinks it might be typhoid. Most of us - if not all - have had shots for it, so there is not too much danger. Just hope they don't quarantine the whole ship in Calcutta.

About 5:30 a short developed in the GEP sparker cable, and a bolt of man-made lightening jumped from cable to the rail of the ship. Three men scared spitless, nobody hurt. The magnetometer was just starting to pick up an anomaly ~~and~~ when it happened, so mag fish had to be pulled in so we could stop to pull in sparker cable to fix it. That took just 2½ hours, and now at 8:00PM both are back and working, and the area where the sparker cable goes over the side has been roped off. We missed about 12 of our 250 miles of run. Let's hope they were not the critical ones!



April 23, 1964 - SE Bay of Bengal off Preparis Island

It is now 8:PM, and we are back up to speed after the GEP run and headed for the mouth of the ~~Hooghly~~ river to pick-up our river pilot for the run up to Calcutta.

As today started, I took the midnight to four watch back at the 'gepper shack'. It was long and dull. Somehow sleep seemed more important than breakfast, and aside from one interruption by Barbee ("Hey, Doc, wake up and start thinking") on the location of some grab samples for the Calcutta River Commission, I slept in a damp sort of way until 10:30 this morning. By noon we were getting a good record on the GEP with considerable structure showing through the noise. At 8:30 AM we had come right to 323° after passing Preparis Island to starboard. By one PM we had some good fixes and switched to 326° in order to make good the 328° we wanted. We finished the run at 5:30 this evening, pulled in the two long streamers, and by 6:08 we were under way at 235 RPM for the mouth of the Hooghly River - due there tomorrow night. The end of the GEP run was at 15°10'N, 93°04'E.

April 24, 1964 - Northern Bay of Bengal

Up until 6:30 this evening, the day was so utterly without incident that this book just sat unopened. The bottom was dull, the magnetics climbing slowly, the gravity meter might as well have been on a bench ashore for all the variation it showed, even the sea was a gray-glass calm with just enough haze to obscure the horizon so that the sea and sky were a hot white continuum. I tried to read on deck but was constantly interrupted. Since my talk to the crew the other day, they all feel I have the answers to everything, and I am besieged with questions. I'm delighted to see the interest and am glad to help out, but it is not conducive to getting a book read. I finally came back into my room about 3 PM to read in my bunk, but the heat got me, and I dropped off to sleep until 5:30 when DeWald woke me for dinner.

After dinner, I was sitting at the British movie up on the boat deck aft - we were nearly at the end of the first roll, when I heard the PA system calling "Dr. Stewart, please call the bridge."

As I walked into the coolness of the air-conditioned chart room off the bridge, I glanced first at the PDR - as I always do. It is a reflex action, like looking out the window of a plane when you first come awake or looking at the sky when you first go outdoors in the morning. It's a means of

getting your bearings, of establishing your reference framework!

For the first time today the bottom was showing something other than the gradual rise we had been getting on this 323° run toward the mouth of the Hooghly. The bottom had dropped off rapidly along a steep scarp with a 1 in 13 slope from 590 to 745 fms. After a gently sloping smooth bottom for a bit over a mile, the bottom rose in a series of steps to the bottom of another scarp. This one rose from 642 fms up to 200 fms, a height of over 2600 feet or five Washington Monuments over a distance of less than 3 miles. This was our first crossing of the Ganges Submarine Canyon - the first of many after we leave Calcutta.

We picked up three sediment samples with the Shipek beartrap as we ran east in shallow water toward the Pilot Boat. The Calcutta River Commission had radioed us asking that we get data on the progression of the tide wave "as you come up the Bay of Bengal" (!!!) and that we provide them with data on "the nature of the bottom material on the continental shelf at the head of the Bay of Bengal". There

is little that we can do at 16 knots to let them know anything about tides or tidal currents, but we could provide them with bottom samples.

25 April 1964, Hooghly River

It was about 6:30 when I awoke, and I could tell immediately from the motion of the ship that something had changed drastically. We were anchored. We had picked up the pilot last night and in company with three real rust buckets - one burning coal - were anchored in the gray-green moving mud of the Hooghly waiting for the night tide to move up. All four of us were pointed down river against the incoming tide, and the water moving past was loaded with fine sediment - too thick to drink, too thin to plow.

We were underway up river a bit after 9 AM, and I know

what Tipling had in mind when he wrote about the "great gray-green greasy Limpopo River all set about with fever trees." The Hooghly River is gray-green and greasy and - today - busy with shipping. Freighters and tankers headed out have passed us in the narrow channel of this broad river. Lots of sailing craft - dhows have been working up, down, and across the river. Ensign Jones has been keeping track of how many go by in an hour to get an average figure of traffic intensity - we call it the Jones - Dhow Average, - sorry.

The country back from the low banks is flat. There are occasional clusters of a few red-tiled roofs in a grove of palms. Each such cluster usually has a group of river-watcher squatting along the crest of the bank staring at the passing ships. Fortunately there is a good breeze added to our speed which cools things off a bit - it is down into the low 80's, but still muggy and sticky.

The banks slid by swiftly as we made the better part of the run at about 16 knots. Some dozen or more red brick yards slid by, the pit where they dig the red river clay lying well below river level but kept dry by the narrow dike piled high with stacks of bricks. Several jute mills slid by - neat buildings with green lawns and trim company houses. A small dock was before each mill where a hungry crane dipped deep into the entrails of a dirty low barge and pulled back with

a mouth full of cut jute. As we passed close to the occasional houses, kids called or whistled to the ship, and the houses and docks became more numerous as we neared Calcutta.

We passed all manner of ships and boats. There were rusty unpainted Lyberian and Panamanian freighters, side wheeler river boats, the needle-ended narrow sculled fishing boats, small sail boats whose sail looked more like a flag than a sail, freight boats with ten men at the stand-up sweeps, one at the helm and always one atop the freight sitting holding a big black umbrella. The river grew busier and narrower as we neared Calcutta, and the water was so dirty and thick with sediment that you felt that the wake would be a plowed furrow rather than a wave.

It is now just 4 PM, and we are slowly moving through the narrow lock into Tiny George Docks, just south of the center of the city. From the lock we moved into a very crowded area with ships of all sizes, Japanese, Italian, Indian, and Swedish plus many of the small oar-powered barges and the high-sterned junk-like freight boats. As the tug Chameli eased us into our assigned niche, there was a two man-powered barge in the way, so she merely nudged her aside, and the Pioneer just barely missed nudging her too. We were tied up at 4:20, and we hope the man standing there below the big crane, the man with the arm full of big manila envelopes, has a batch of mail for us. It lacks

only one day of being a month since we had our last mail at Singapore.

CALCUTTA TO COLOMBO

May 2. 1964, Hooghly River –

That man standing on the dock some seven days ago at Calcutta did not have mail, although there was a good deal of mail that did come aboard. He turned out to be Sterlyn B. Steele (& Elaine at 7 Moira St. Calcutta 16) of the U.S. Information Service (USIS) and from the moment he stepped aboard we were in a continuous maelstrom

of press conferences, movie shots, radio interviews, open house (almost continually) receptions, special lectures, two days of scientific sessions, - the works. It was - for me - a hectic session, but I honestly feel that, busy though it was, our stop at Calcutta was the best yet in terms of doing something for science in general and for the United States in particular. The batch of envelopes Steele had carried aboard when we arrived contained our "schedule" invitations for 3 receptions, printed brochure for the special seminars, Calcutta directory, list of people invited to the Consul General's reception, etc., and a separate envelope for each of the officers and scientists. USIS had worked closely with Dr. Panikkar, chairman of the Indian National Committee on Oceanic Research and with Dr. Malik, Vice-Chancellor of Calcutta University, and chairman of the local Hospitality Committee. They had quite a schedule planned, & I think we did OK for USIS too.

Sunday the 26th was a big press conference which lasted actually all day - what with All-India Radio wanting interviews, Metronome News wanting a special tour for their cameraman, etc. Then the Captain's reception that eve for local wheels and scientists followed by a dinner for the Capt., Cole, Hale, and me given by Sarma and Borglund at Firpos.

The rest of the stay will - perhaps - be documented later, for things are happening.

We left the dock finally about 0800AM this morning, eased out into the river - now covered with whitecaps from a strong south wind - and started down. Since I had been up until after three this

morning, the trip down the Hooghly River was a good time to sleep. Last night was the first time during the entire stay that I could go over the mail that had come from the office. Max Ricketts got a long one in answer to his and Ted's, wrote Maro, Paris, Max Doty (who never did show at Calcutta) and – of course – Leel, plus Ken Weidner in Beirut, etc. These all went off when our agent left about 0600 today.

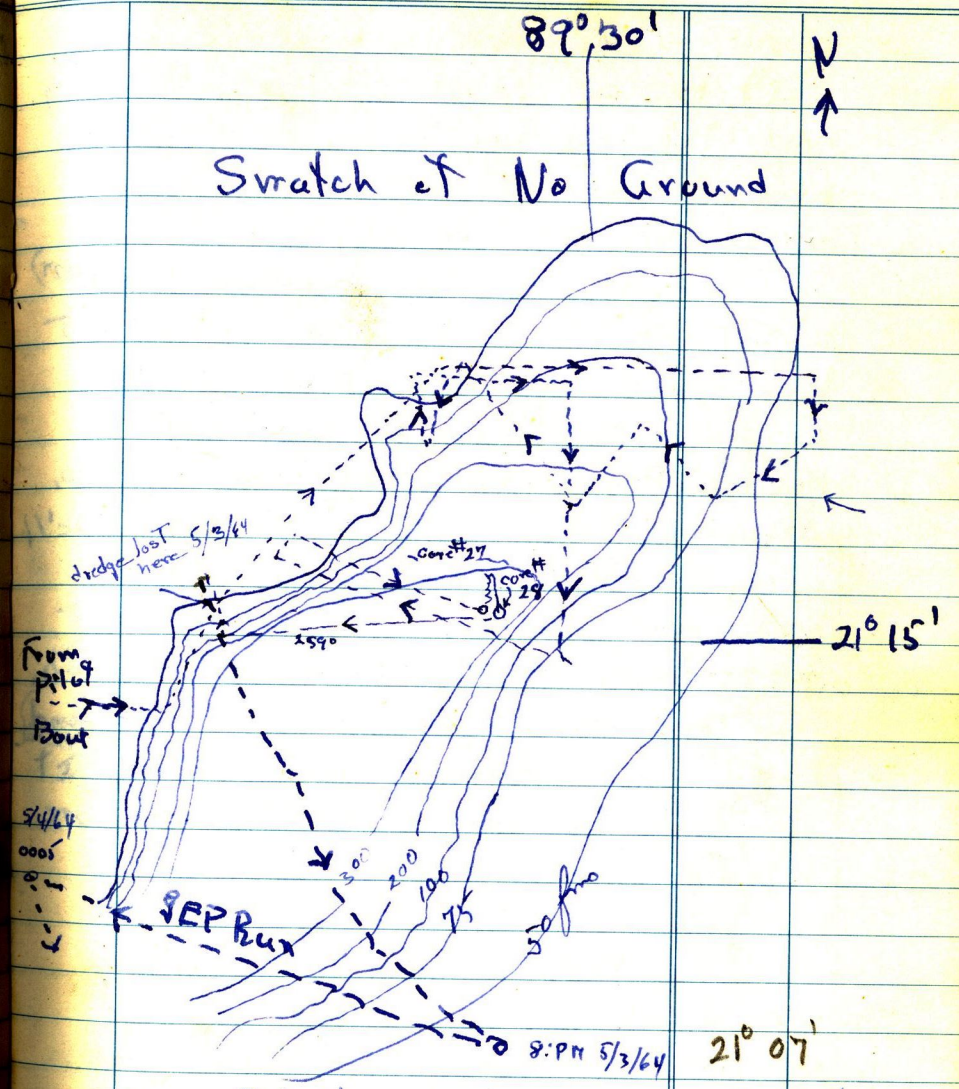
Barbee, Moses, Fran Shepard, Bob Dietz, Rodolfo & I all had a planning session about 9 this morning down in the plotting room and set up in general the first few days of work in the Swatch of No Ground and the lower Ganges Canyon. Then I went to sleep during the run back down the river.

By the time we had reached the lower Hooghly, the shallow estuary was lashed into a froth. Things had been well tied down, as the river pilot had told us the Bay of Bengal was a mess, and the silt-laden Hooghly water was sloshing along our decks and blown over the entire ship. By 8:00 PM we had dropped the pilot, who for a while thought he would be forced to stay with us to Ceylon unless his little boat ~~stopped~~ could get in to pick him up. I left a call for midnight when we were ~~[illegible]~~ due to get to the Swatch of No Ground at the head of the Ganges Canyon, and staggered up to the pitching rolling chartroom just as the watch was changing a bit before midnight.

3 May, 1964 Swatch of No Ground

We were in about 36 fms as we hit the western edge of the Swatch, and switched course to move north along the western edge to give us some sort of a position check. The chart which the Pakistani Navy had made was good and our crossings of the two indentations tied in nicely. We slowed to 165 RPM and came right to 010° for one good crossing. In mid-valley we must have picked up some mean currents toward about 080°, for our DR just fell apart. I worked out a separate sheet with the soundings and did some adjusting. We were getting a good set.

We wanted to zig and zag across what appeared from the soundings to be a small scarp in the axis of the canyon - either a scarp or one boom line on



The Pakistan Navy survey. That line obviously was no good, for no scarp was found. Then we ran south along the axis, and I quit

about 0500 as Barber came on.

It is now 12:30 in the afternoon and the 20-foot corer has just been pulled out of the canyon axis at 290 fms. We "grabbed" a few samples and then lowered the (#27) 10-foot barrel on the piston corer. It had gone in all the way to the top and seemed to have sand in the bottom and soft fluff on top. So we tried a 20-foot core. We'll dredge next, then camera the wall and bottom before we start to follow this feature to the south.

That core was from 285 fms and tripped with 1757 feet of wire. It is serial No. 829 and core number #28.

We left the core station on course 259° to start a dredge on the northwest wall.

There is an interesting break from turbid brown water to clearer, blue-green water as the Swatch is approached. This would seem to suggest that the heavier water charged with all that suspended material plunges down the walls and into the valley leaving the water clear in the Swatch itself.

By 1:42 PM we had crossed the ~~see~~ floor of the valley and came right to 352° to get a look at the wall we are to dredge. It was 314 fms when we turned at 2 PM and it rose nicely up to about 22 fms when we turned back on a Williamson turn to get back to the dredge site. At 2:14 PM we stopped in 240 fms to dredge. At 2:17 the dredge went over in 234 fms. At 2:26 with 1605 feet out in 222 fms we stopped the winch. This turned out to be quite a station. Let's hope all the troubles for this leg are now over! We finally put out just over 2000 feet of cable. Our drift was to the north as we

started, but with a 20-knot wind from the south, the ship kept swinging around to point towards the northeast. We would back around to have the bow headed into the wind and then power dredged. We got some good tugs - but not really "rocky" ones. As we started to haul in about three, I left to go to the daily Brown - Cole - Burdee - Stone session, and we were in the Captain's cabin at 3:15 when the ship gave a great shudder, and we knew something had happened. There had been a monstrous great hung-up which had broken loose with a great slackening of tension. One of the hydraulic lines to actuate the bow gallows frame had ruptured spurting hydraulic fluid all over, and the frame itself had settled back into the stowed position. We tried to recover the dredge, but the cable just chewed into the gallows frame cutting quite a groove. By then the dredge appeared to be hung again, and we let out some cable to relieve the strain. Finally a comealong was put on the line, the strain taken up on a new line, and Lavery's boys went to work rigging a cross-bar and a snatch block to carry the cable over the forepeak. They removed the cable from the groove, took up the strain on the cable, removed the comealong, and we started the haul in. It was now well less than 100 fms, and we had a mad wire angle. With considerable jockeying the dredge was freed and by 5:00 PM was at the bow. There was no way to get it over the bow, though, so the heavy manila was

brought foreward outboard of the starboard rail, and the dredge was taken aft through the water for recovery aft on the boatdeck using the big crane.

Up it came, and it was the jam-fullest dredge haul I have ever seen. As it broke the surface, I could see that the mouth of the dredge was so choked with clay that there was a small lake of water sloshing around in the mouth of the dredge. Beneath this plug of clay were many large irregular chunks of the same color as the clay. I am 90% sure that they were of the same clay, but they were stiffer and had in all probability been broken from clay outcrops on the wall. Then it happened! The large pelican hook with which the manila was hooked to the dredge chain parted. It did not come unhooked, it broke on one side of the heavy steel ring. We all watched impotently as the dredge and chain dropped, bounced off the outer edge of the lower deck, and dredge and sample were headed back for the bottom. We did recover some of the clay from the large valve off which the dredge bounced on its way down. It was a stickey blue-green greasy clay. The dredge, however, is lost, and we will never know what those samples in the bottom really were.

It is now 7:00 PM, and we have temporarily cancelled the camera station until the gallows frame is either fixed or is pushed outboard and locked in the out position.

Back, briefly, to Calcutta. On

Monday morning the 27th, there were more photographers aboard, more sessions with local people, and we met the cars at 12:00 to take some six of us to a special reception given by Dr. Malik, Vice Chancellor of Calcutta Univ. Also there were Dr. Paoinkar, Dr Willie (an American, former U of Minn. man here on a Ford grant to help Calcutta University), Dr. Roy, head of the Geological Survey, Dr. Bimichar, head of the central Inland Fisheries Research Institute, Dr. Roonwald, Director of the Zoological Survey, Capt. Sonpor, Indian Navy, Dr. Bose, head of the Bose Institute, plus 3 or 4 more I don't recall. It was a good lunch at the Great Eastern Hotel, fish, beer, mutton curry (and hot too), japatis - their Indian counterpart of Mexico tortillas - and custard, coffee, and cigars. I went back with Sterly Steele to the USIS office on Chowringee St. and from there went out to the Bose Institute for my 3:PM lecture. It was a big hall, and I would guess there were about 200 people there. The lectum was a magnificent thing with a great brass bas-relief of the sun giving it's daily power to the world. I felt like the President addressing Congress. They threw no fruit and did clap when I quit, so I guess it was adequate. The local press gave it quite a write-up the next day. Afterwards I went with Steele to his apartment in town for a cool one and back to the ship by about 8:30 PM.

The next morning - Tuesday the 28th - Dick Stephen-Hassard lectured on toxic fish at the Fisheries Institute, Bob Dietz arrived and lectured that afternoon at the Geological Survey, and Capt. Brown, Barber, Kotler, and I went with Sataye and Tombe,

, both surveyors with the Hooghly River Commission and both former USCGS trainees, on a shopping tour. I managed to get my ticket from Colombo to Paris all confirmed and got a fine batch of stamps at the GPO to put on my various letters. Stopped at the Bengal Home Industries spot where I got two interesting paintings plus some of the very cheap clay toys I like. Had to get a couple of native costume dolls for wee Dodie, but nothing else really appealed to me. Had a few beers with them and then back out to the ship in a downpour to meet the movie cameraman, to get shot up some more for the local newsreels, and to dress for the American Consul General's reception. He is William Baxter (Princeton '38), and he, Capt. Brown and I were the reception line.

It was a nice reception in the garden of his residence right next to the Consulate on Harrington Street. It was late when B. Hale and I got back to the ship - being almost the last to leave.

The next morning we were all up early, as the two days of seminars were to start at 9:30 AM. These were held at the Berla Museum of Science and Industry, and people had come from all over India for these sessions. The American Council General led off with an introduction, then Panikkar telling of the Indian contribution to the IIOE, and Brown in a short speech of welcome. I then gave a 45-minute talk on the Pioneer Expedition, and the sessions were off and running. Barbee, Dietz, and Shepard all gave good papers. The Indian ones ran the gamut

from the Excellent one by Dr. Krishnan, former head of the Geological Survey, who described the Bay of Bengal geology - to the several incomprensible and unintelligible ones by Rao of Andhura University. Shepard's movies of sand falls and his recent dive in Cousteau's "soucoup soumarin" made a big hit the second day. Panikkar, Steele, and I wound the second day's session up with short speeches of appreciation, and we were through about 5 PM on Thursday night. ~~The~~

The night before, there had been an excellent tea party and "culture program" given by Dr. Malik at the Calcutta University Rowing Club. There were little Bengal sweetmeats - curd balls filled with fruit juice, pressed sugar candy, small tarts full of hot things, and tea.

called "carfee"

called "samosa"

The "culture program" was the greatest yet. A troupe of professional dancers and musicians gave a fine preformance of Indian dances, of folk music, and musical poetry. One Assam folk tune done mainly on a shepheard's flute was a lovely thing.

~~Friday~~ Thursday (Hooghly) evening Mr. Adolfos of the River ~~Commission~~ Survey had most of the wardroom to drinks and dinner - a nice relaxy type evening. Friday morning the Captain and I entertained River ~~Commission~~ Survey people until the USIS car came to take us to town for some pictures in front of ~~before~~ the special exhibit USIS had put up outside their offices, and we both came back - he to meet guests aboard for lunch, me to be met by Panikkar who together with Drs. Roy and Bimichar took

Shepard, Dietz, and me to lunch at Firpo's. I then spent the afternoon at USIS trying to answer office mail, but had to interrupt for one more trip to the GPO for more stamps. Met the Steele's at their place for a drink, and got back to the ship about 8PM to put in something over seven hours down in the plotting room getting out answers to the Washington mail.

It's now nearly 11:00PM, & the GEP has been operating since a bit after 8PM and - praises be to Neptune - is giving some excellent results. We'd crossing the valley on course 270° and making good about 265°. As we came into the area we could see a folded area beneath, then as it dropped off onto the valley floor, there was a decided change. The irregularities disappeared, and the structure appeared as a deep valley fill. Without even trying, you could almost "see" the slope continuing down below the sediments. This will be a fine crossing.

Have just had a cup of coffee with Colonel M Ghosla who joined us at Calcutta. He is Col. M.L. Ghosla, Chief, Geodetic and Research Branch, Survey of India, and was also a trainee at the Bureau some years ago. He is a fine fellow, Punjabi, and so far seems to be having a good trip other than a bit of mal-de-mer. Actually the sickness level is fairly high. Three have had bad fevers and very sore joints - sounds like dengue to me - I had it in Manila in '45, and their symptoms sound familiar. Reggie Harbison is in sick bay with

some sort of fever and severe inflamation of the skin of his left leg, and Dietz has felt unsettled for two days now.

Dr. Subba Rao did not join us at Calcutta. He was there, but he had dragged his feet in getting a passport — Panikkar was furious at him "If you had but told me, I would have brought you to Delhi to arrange everything. Nothing could be done for him, so they tried to find a replacement replete with passport, but that too failed. So at Calcutta we added Col. Khosla, Fran Shepard, Bob Dietz, and Sam Bush and lost Burns, Keller, Peter, Ong, Linberg, Sarma, and Borglund - a net loss of three. Subba Rao may join up at Colombo for the run to Penang and there may be one more Indian. No Ceylonese

came aboard either.

It's now quarter to midnight, and we are well upon the bank at about 20 fms with still a fair SEP record, but the direct water wave now masks the first bottom return. We decided to run it until 0020 hrs or 20 fms, so it looks as though it's about to come in very shortly.

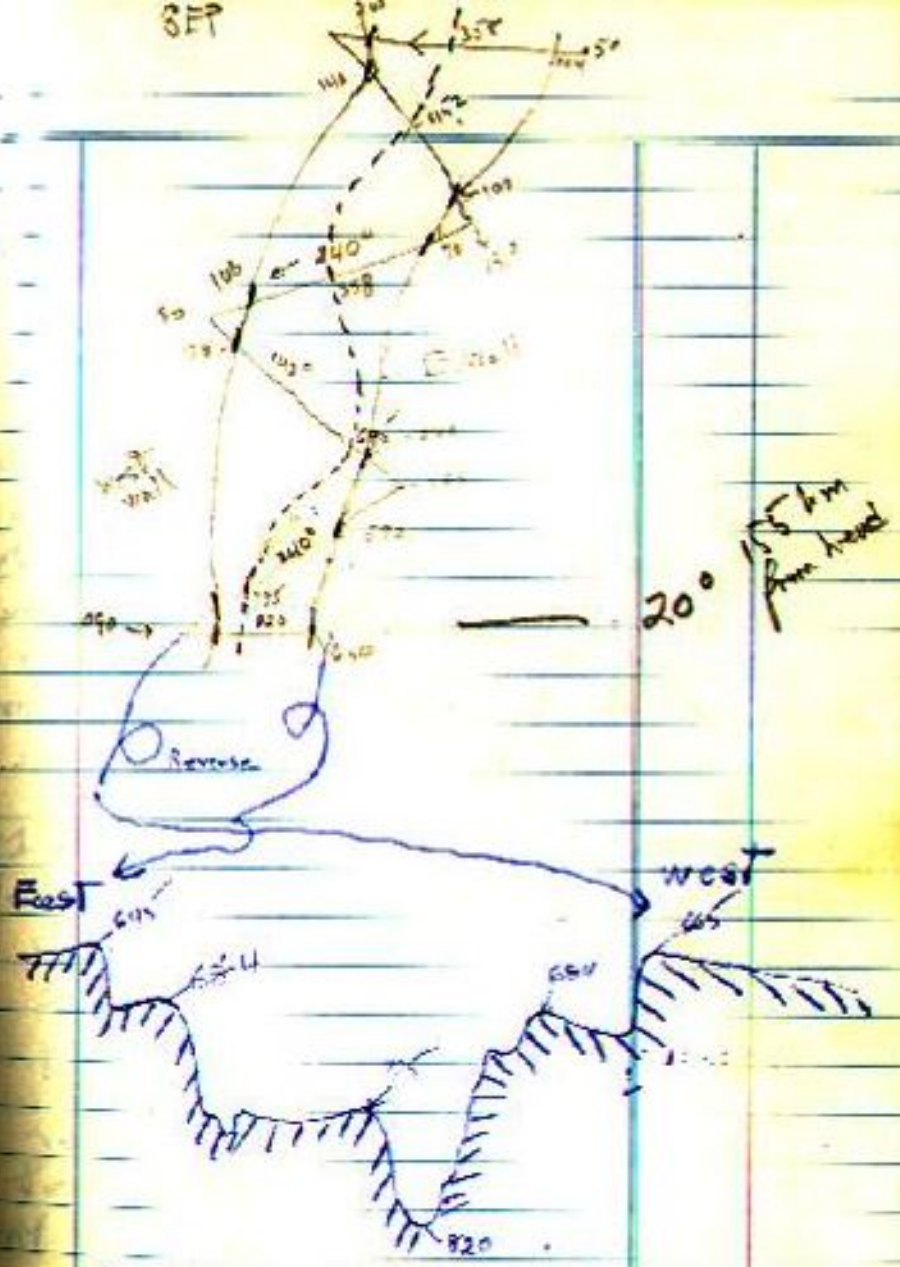
On the western wall, it appears that Shepard's idea of post-canyon sediments building up the sides is a valid one, you can see flat-lying beds dipping downward as they ~~approach~~ approach the valley.

SEP secured at 3 minutes past midnight after what Austin Weeks has just called "a darn successful run". I must agree.

Fld Bk for ITLII

May
4 ~~April~~ 1964 - Ganges Canyon (valley?)

Fran Shepard woke me at 0645. He had been up a while and we had crossed the valley on course 142° ~~240°~~ and he wanted to turn to get a crossing normal to the valley. Since this involved a change in our planned operation, it required me then Barbee to get any such request executed. 3, the time I got up to the chart room and looked over the plot, that was not the place to do it, as we would not be that sure of the trend. I convinced him to wait and that we'd do a normal-to-the-axis crossing just before planting the buoy. On this crossing, probably just about normal to the axis, the east and west banks (at 645 fms and 665 fms respectively) both appeared to be leveed. From west to east, there was a terrace (leveed) at 654 fms, the bottom at 820 fms, a terrace (leveed

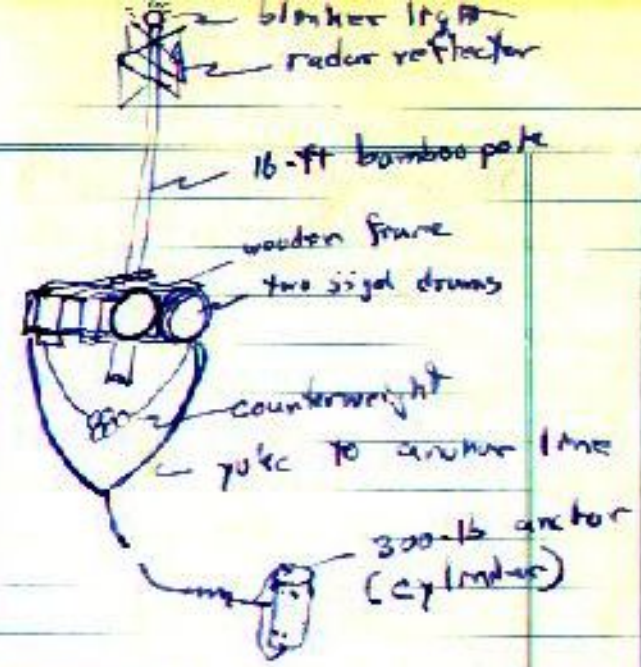


at 775 fms, another at 654 fms, then a steep rise to the east crest at 645 fms. again leveed (about 10 fms).

We turned back west at 10:49, pulled in the mayfish, and now at 11:40 are moving on west to plant the buoy.

The plant went well. It was in 758 fms, and the big red & yellow awkward buoy was swung outboard from the boat deck by the big crane and lowered into the water. It landed on its side, the lowering line was cut loose, and after sitting on its side for a minute, it slowly righted and started drifting astern as the line was played out. It took the 3 full reels of polypropylene line plus a few shots of the 3/4-inch cable left from the old dredging winch.

Once in and the anchor over, we started our first run to the east, up onto the lip of the canyon and then turned as the already



faint blip on the radar scope disappeared completely. The turn is the standard hydrography turn of 1/2 minute. On the way back - almost up to the buoy, we could not pick it up on the radar. The background clutter was too much for the small reflector. We crossed the arts, climbed the west wall, and returned to the buoy while the Capt, CDR Cole, LCDR Barbee and I held a conference as to the best way to improve

the reflectability. It is still pretty windy with a good sea and swell running, and although Larry felt a launch could be put over, it would be touch and go at the best. It was finally decided to add some aluminum to the second expanded metal reflector they had made, put a wire loop above it and slip it over the top of the bamboo pole by coming up on it with the Pioneer.

On the third pass, it worked. Dick Johnson, Chief Carpenter who had made the buoy, was on in the bucket and tossed a noose neatly over the madly gyrating top of the pole. It was hauled close for only part of a minute, the loop and additional reflector dropped over, and the line cut to allow the buoy to drift free with its new load.

This new load, however, was just barely too much. It had been planned to hook the new reflector inside the guy wires holding the bamboo pole but there had not been time. The reflector swung out in the wind, bowed the buoy down until the loop slipped off and the badly-weakened light and the entire reflector were pulled into the sea. The buoy — almost with relief — righted itself and went back into its former gyrations.

It is now a bit after 9 PM. The buoy has been recovered and hauled up onto the boat deck. The last of the polypropylene line is coming aboard and the anchor apparently is still attached. The plan we worked out is to repair the buoy tonight with a larger reflector and a new light. While that goes on, we

will continue our zigs and zags across the ~~canyon~~ canyon on to the south. In the morning, we can see how it looks then for our hydro buoy survey. If it is not the place, we can run back up to where the best place might be. At least we will continue getting new information through the night.

While the buoy line was coming in, some 30 to 50 medium sized sharks cavorted in the spoilt waters off the starboard side. Hofer and Schimke were shooting at them — others were fishing for them. I saw at least two who were hit. They thrashed a bit, white belly showing, and then went into a long slow downward spiral. At least one was caught, but

In general they avoided all bait tried - bread, spam, and even the remains of the good New Zealand beef we had for dinner tonight.

The 15-20 knot breeze from the south-southwest is cooler than I would have expected. The ship is considerably more comfortable than it has been for some time, although we all still sweat a good deal.

The dockside at Calcutta was a sight to see. On the small flat barge between our gangway and the dock there had accumulated by the end of the first day, one skirted guard who always pulled his bare feet together and saluted nearly everyone, three cobblers, two barbers, one purveyor of magazines and pocket books, assorted

short-term merchants of everything from coarse hand loomed material ("real Kashmir, Sahib") to Ghurka knives and filagree silver, and of course one or two small boys trying to catch crayfish, and the ubiquitous beggar.

Once when the Captain and I were returning from USIS and a picture-taking session, the walking news-stand hailed us at the foot of the gangplank. To the Captain he pushed a copy of the Asia edition of TIME magazine which he bought. To me he offered not TIME, not NEWSWEEK or LIFE, but digging down and pulling out a large sized book from the bottom, to me he pushed the Kamasutra, ~~[illegible]~~ Hindu Art of Love - which I bought. It wasn't until later that I stopped to wonder what there was that made him offer Ed Brown the TIME and me the Kamasutra. Anyway, I am glad to have it. Written in the 3rd or 4th century during the "Golden Age of Indian Culture", it is one of the great classics on sexual love, and a magnificent chronicle of the social customs of the times. For example: "The causes why a wife has to suffer the miseries of the presence of a co-wife or co-wives or why at all the co-wife is brought ~~are~~ out as follows: -

1) stupidity of the wife
2) her contrariness or bad temper
3) her unchaste activities
4) her ugliness
5) her remaining ill always
6) her laziness and slowness
7) her barrenness or giving birth to girls only, or
8) her inability to satisfy the love-desires of her husband."

I'm sure number 8 would not be the reason in houses where the Kamasutra were to be found!

There are recipes for increasing the vigor, for aphrodisiacs, for luring the lover, even this one: "Take the excrement of a peacock that has eaten yellow and red arsenic, and smear the hand with it. Anything touched with this hand will become invisible." It contains detailed instructions for every possible act of love, and it also contains a good deal of sound advice: "Where both parties (of bride and bridegroom) treat each other on a par; where neither tends to bring the other under its thumb; where neither behaves with the other arrogantly, union between such parties is proper and best."

Now at 1110 PM we are on course 240 headed back across the canyon. All seems to be off, so at 1130 I'm in the sack. I left word to have the watch call me if they had any problems I could help with.

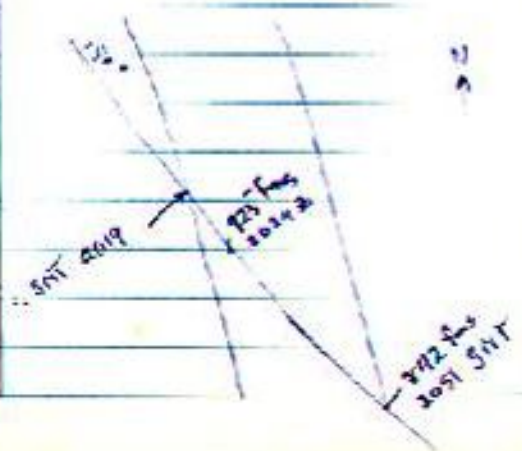
5 May, 1964

The day started out in rollicking fine style at twenty minutes after midnight, when I was called by the quartermaster on the 12-4 AM watch, Mindiola. When I went up Ens. Bliss was uncertain as to what was happening on the bottom. As he ran from east to west along 240°, he'd gotten a good crossing with 720 fms on the east bank, 945 fms on the axis, and 908 fms on the west bank. But then the bottom had gradually fallen off until it had gotten down to 820 fms at 20 minutes after midnight - almost as deep as the canyon floor. I had him come left immediately to his return course of 150° T. heading back and then explained that we were essentially crossing a long gentle grade at a shallow angle, so the depth would continue to drop even though we had crossed a gully en route. We had gone some 30 minutes past

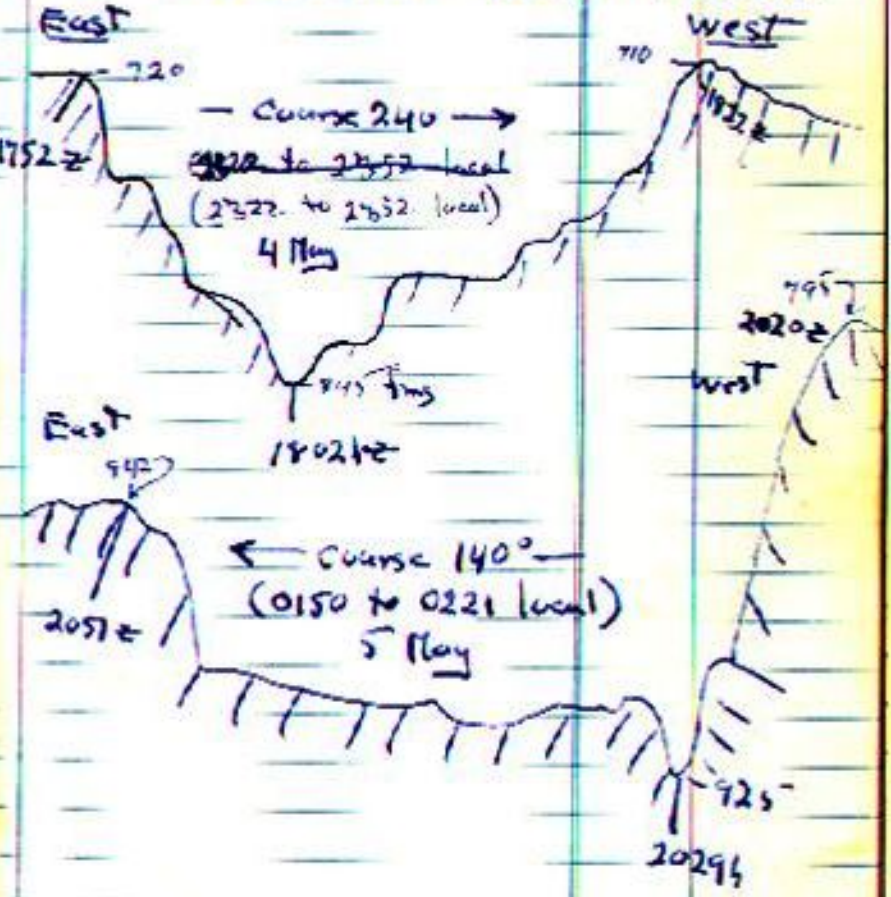
the western bank, so it was a long run back to the canyon on the 150° course they had set up for the night order book.

We obviously are no longer at the 45° to the canyon the courses were set for, so it may be a long run across. I'll hold off calling the Captain to get permission to head off at a better angle until I see how it goes.

It is just 2 AM, and we have started down, but I'm afraid it is a ~~pretty~~ low angle, and the canyon will appear to be pretty wide as a consequence.



The western "levee" on this crossing crested at 795 fms, the axis is now down to 925 fms, and the eastern "levee" was at 942 fms.



We changed back to 240° and got the eastern "levee" at 850 fms, the axis at 975.

It is now just 0330, and we are on our way back up from the axis, and I'm for bed.

Fran Shepard woke me about ten with something that I could not understand, and when I fully awoke, he had left. I had a cup of coffee in the wardroom and went up to the chart room. We were getting three channels at depth instead of only one, and the ship had worked its way back up the valley on NW and NE courses zigging and zagging to make our previous pattern into diamonds by cutting midway across our earlier lines.

The big buoy had been repaired during the night and morning. Larger reflectors and some expanded metal had been added to the top, more weight to the bottom had

been added in the form of a long heavy pipe ~~and~~ extending below the floats, and a new light. We made one final west-to-east crossing along the line where the buoy was to be planted, turned back, and lowered it over in 925 fms at about mid-canyon. The ship was rolling in a good swell, and the buoy swung out and back to bang the side of the ship. It appeared that the lower pipe counterweight was not straight as the buoy entered the water. ~~and~~ The ~~buoy~~ buoy floated, but the mast and reflectors were at a rakish angle of about 30° off the vertical. It seemed to remain at that angle and rode out the waves as it drifted astern as the line was

played out and the anchor put over. The larger target showed up well, but as we approached for evening stars about 5 PM, I watched with the Captain as it dipped its flag each time the pole rising less and less high. Finally, it lay flat and stayed there. Our buoy work was over - again.

A workable location buoy, preferably with a transponder, a good flashing light, and an adaquate radar reflector is an absolute necessity for the Coast Survey. It should be compact, easily launched and recovered, and essentially foolproof. Proper anchoring cable and an explosively penetrating anchor should be part of each one. We have lost expensive time jury-rigging buoys out of empty drums, bamboo poles, and scrap metal. They have not worked. Each major ship should carry two of these as standard equipment with additional ones available for special jobs. Upon my return, I will see that some sort of investigation of existing shelf gear ~~can not be~~ is initiated. If adaquate buoy is not available, then we'll design and test our own, and others can use the "Coast Survey Position Buoy." With all our RAR and Roberts buoy experience, this making-do aboard ship is a waste of time, energy, and money.

We all knocked off for dinner and to think. Since I do not eat until 5:30, I could think while the others ate. My plan is to recover the buoy and line and - at least for the time being - to forget about buoy-controlled hydrography. Since the deck force

will be tired from bouy rigging on recovery, we'd have them & stream the GEP and then get a full night's sleep. We'd run three full GEP crossings normal to the canyon with 2-hour north-south runs between. Then we'd dredge the steeper wall, core the top and bottom, run a camera station in the canyon and - hopefully - down a wall, and then head down-canyon to continue following it south.

I talked over the idea with Barbee and Fran, and they both agreed to it. I went off to check on the degree of readiness of the GEP hydrophones, and I sat down to dinner.

It is now 9:30 PM, and the GEP has just been streamed. We are starting the first run.

May

6 ~~April~~ 1964, GEP crossing across canyon

I worked away in the chart room during that first run making an overlay of the chart and putting on times, fix numbers, and the point of axis crossing on each. The southern two crossings had - each - three valleys - the one above clearly only one. I quit about 11:30 after looking in on the GEP shack and volunteering to take the 0400 to 0800 watch this morning. Records look fair only.

0430: So far the first half hour has been spent trying to get the right paper-tension setting on this miserable machine. It is a capricious thing and may be related to our odd roll.

(Course 270° crossing west wall)

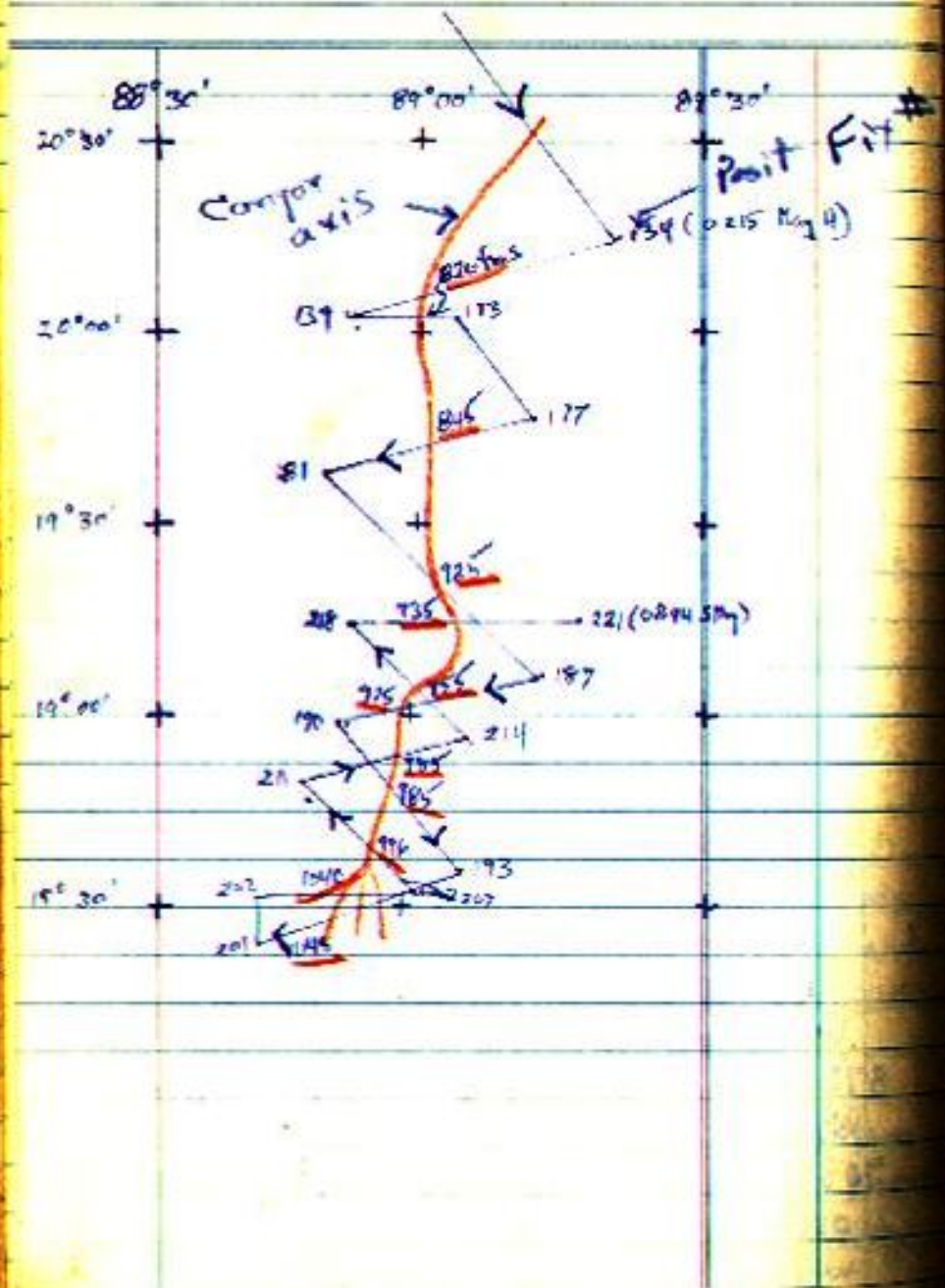
Reggie came up about 6:30 AM, and adjusted the paper wind knob, so the major trouble was solved. As we came up the west wall, the record suggested faulting as the source of these terraces, and the cross-arrangement of the bedding further suggested a forest and tepee structure to the levee at the crest of the rise. These records will have to be filtered and carefully studied, but I believe they are really quite meaningful.

It is now 0915 and the QEP is coming in after three good crossings. We'll next dredge, then core and camera. It should be an exciting day.

We heard from Ceylon while in Calcutta, and it looks as though we are off again. The schedule tentatively looks like this:

May 18th – 0900 ~~Arr~~ Arrive Colombo
19th – PM – press conference aboard
20th – 1430 – Seminar at Chemistry Theater, Univ. of Ceylon followed by discussion groups.
21st 1900–2030 – Reception at Embassy
22nd Reception aboard – 1830
23rd Open house aboard all day
24th – free
25th – sail 11 AM

By 1040 the dredge started down. We had crested the "levee" at 870 fms, and the bottom sloped steeply to the first terrace at 905 fms. The dredge (#16) had to go over from the boat deck, as this was where we had stored the



Two new ones built at Calcutta. By the time it ~~started~~ got down to about 200 feet, the bottom had shoaled all the way back up to 865 fms again. Our drift up slope was considerably faster than we had thought, so we hauled it in and ~~left~~ moved back east ~~at~~ onto the lower terrace, and a bit farther east than before. Since the terrace crest was shoaler than when we first left it, (on our return) our drift must be to the northwest, and at a fair clip too. When recovered there was a bit of clay sticking to the dredge, but ~~all~~ nothing else.

Actually, a rock in this one would have created a real problem, for this is a delta-front type valley and should be soft deltaic sediments.

Then two cores. The first one we put plunk into the narrow valley bottom at 960 fms. We then

moved up onto the levee to the east side at 8:55 fms and got another three. The valley lowering got a fine clay silt in the gravity corer used as a trip-weight and about 8 feet of sample in the big piston corer (#) with fine sand at least at the top and bottom — just as might be expected. The levee one — also as expected — was 18 feet of fine silty-clay. (Core #).

Then we checked the east wall for a camera site. Found it, and started down in 865 fms at about 7:30 PM. There was some confusion about the crazy plaid pattern, but once resolved, the camera went on down. Byron Hale and Chief Werk were handling the oscilloscope and the PDR, so I snuck down to the room to get this log caught up.

Mel Field of the Weather Bureau, one of our two meteorologists, just popped in to report that his radiometersonde release seemed to be going OK. This is a new bit of balloon gear that measures incoming solar radiation as it goes up; why it is to be sent up at night, I am not sure and will go back to the met. lab and find out. The gear was sent to us — with incomplete instructions and the balsa wood frame missing — as part of an IGSY-IIOE project of the Weather Bureau and the University of Minnesota. His other routine radiosonde releases have gone well, averaging 28 – 30 kilometers per flight.

At 10:10 Bottale started bringing in the camera and the bottom which had started out at 865 fms increased only 5 to 6 fms during

the entire two-hour run. Our drift must be either nil or right along the contour. I folded about 11:30 while it was still on the way in.

7 May. 1964 - Bay of Bengal -

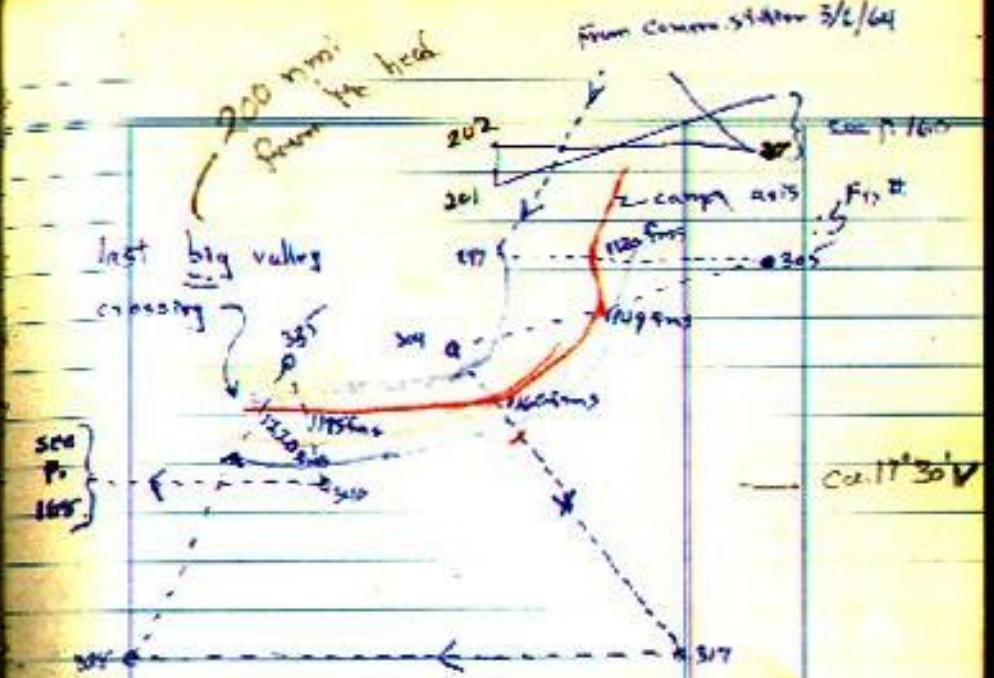
This has been a long day of valley chasing. There is little use in detailing all the zigs and zags here. We ran a long line back down to where we had our southernmost crossing of fix 201 at about 8:11 on the fifth. From there we ran three crossings with depth of axis increasing southward. We then run well to the south-east to be sure we were not in a vast complex of these channels, - we were not - and then run west to hit it again. "It," however, was being coy. The valley had turned west unbeknownst to the likes of us, so we had to run up to find it again. We did, and now we are being coy. We will run west, and wait for it to cross us - for a change.

It is now 11:05 P.M. We had a fire drill and abandon ship drill

this afternoon, the full bookcase in my stateroom fell over on a good roll - a real mess. Shepard showed his underwater film at the movie tonight, and a message from Washington wanted weeks' and Harbison to "remain aboard until SEP work is completed." Other than that it's been a day only of valley chasing. It looks as though tonight will be more of the same.

Just for fun I checked the rate of slope of the valley axis between crossings. Other than one ½ mile section where we had the same depth at both ends, the slope in fathoms per mile ran from 1.1 to 4.0 between adjacent crossings. The overall average gradient has been 176 fathoms in 87 miles or just 0.2% (2 fm/mi).

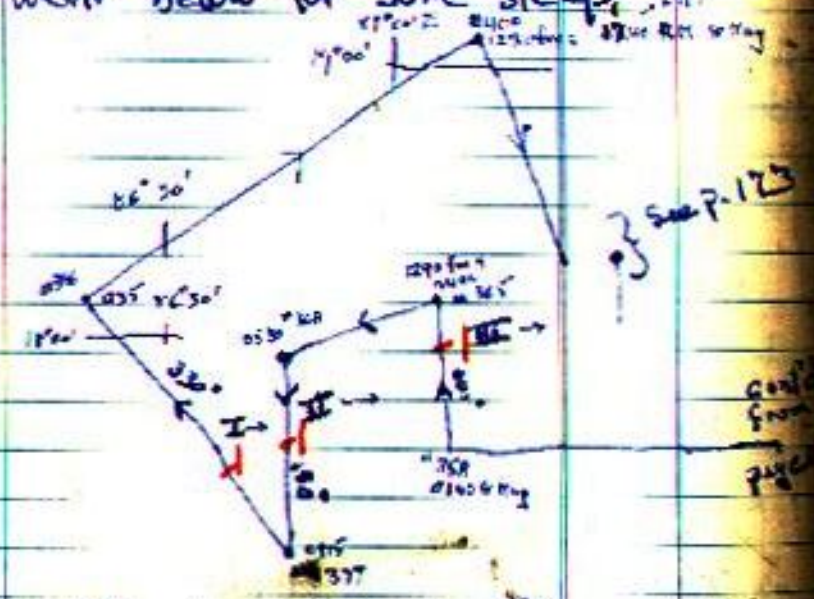
When midnight came around, I was rocking back and forth on the stool in the chart room staring



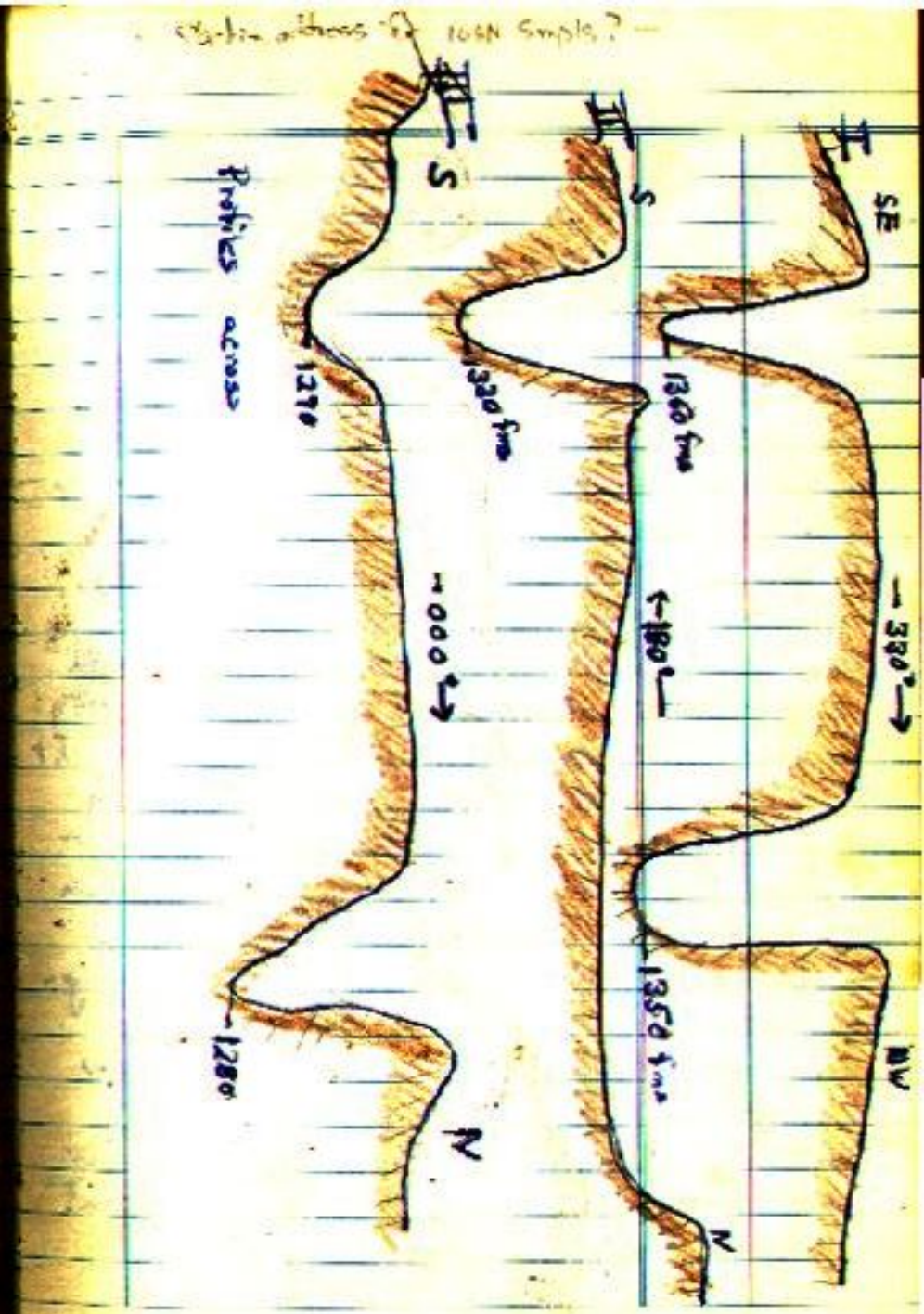
sleepily at the PDR and wishing the bottom would go down. Still no respectable valley crossing. If none shows, we'll turn north - to make a grand total of about 35 miles to the south we have accomplished in 24 hours of steady running. At this rate we'll make Colombo about 1975. On that run north, I want to be sure that we have closed out all possibilities of the valley having run out to the west. The depth will be the clue. Our last crossing - after fix # 328 was in 1220 fms.

8 May, 1964 – Just about where we were yesterday!

At 1:40 this morning we turned to 000° – true north – and commenced to wipe out yesterday's small gain to the south. By 2:30 AM we had not started down into any valleys, so I left a 3:30 call for Bob Dick & went below for some sleep. MT



After breakfast, I went up to the chart room to find we had caught a small valley – much smaller than at the last crossing – at about 3:20 AM and had turned south



at 0400 in 1290 fms of water. At 0530 we had gone south again and picked up a small but smaller crossing at about 8 AM.

Since we knew that our last good crossing of a respectable valley - much bigger than these three or the other smaller ones - had been at an axis depth of 1220 fms (see chart p. 167), we could not be sure that we had caught it, since we ~~turned south~~ ~~left~~ stopped our north line in a depth of 1290 fms. It still could have "snuck out" on us, and we would never know for sure unless we went back up into a depth at least as shoal as our last good crossing and that was at 1220 fms. Since these channels must flow downhill, only by going north until that ~~120~~ depth was reached would we know for sure that the main valley had not gotten away from us. Shepard and Dietz realized that if we wanted to state with assurance that the main valley became several smaller ones, we had to know that we had boxed in the area.

It took almost all day to do it. We found no other valley by the time we turned back southsouthwest at 5:40 this evening, but we turned ~~came~~ in 1220 fms, and we knew there was no other outlet for that main valley.

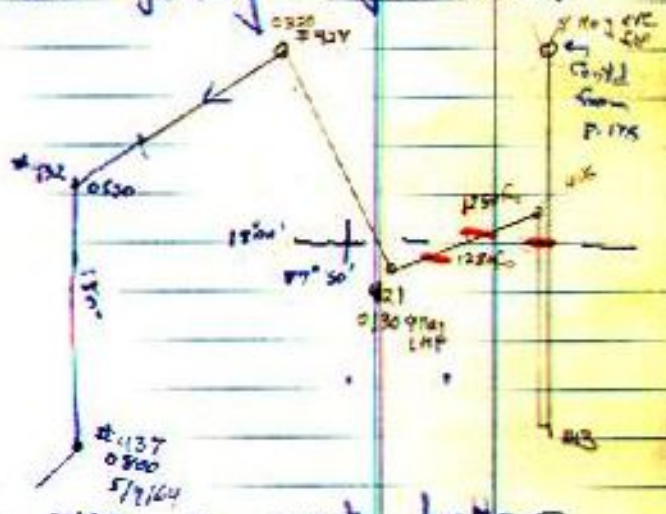
With that squared away, we are now headed south - right now at dead slow for a biological tow - to make a crossing of that smaller valley, and we will zig and zag through the night trying to follow it on downslope.

We are making Foran and Bob Dietz work for their passage. Foran has lectured to the wardroom and shown his good underwater movies

twice and talks to the crew early next week. Bob gave an hour's illustrated talk on the origin of continents and ocean basins today and gives one more in a couple of days.

It's nine thirty, and Bob Dietz is on call to midnight in case we cross it by then. I'll be on call after midnight. Once we have it - and I'm sure we will - we will stick to it like a dog worrying a rat. Bob came by about 1000 as we were in the valley and having troubles getting a good signal. Combination of return ping being right on top of outgoing one, a heavy head sea causing some quenching, and a lot of static. Got Chief ET Werk up here to doctor the PDR, and the Capt. up as I wanted to ~~slow~~ slow down to reduce quenching. It looked like a 1270 fm

axis below a levee that topped out at 1185 fms. At 11:00 we came right to 000° at 165 RPM having switched to PDR #110 and now getting a good echo.



There was a much better profile this trip at 165 RPM. We crossed it, and at 15 minutes into tomorrow turned to 240° to catch it again.

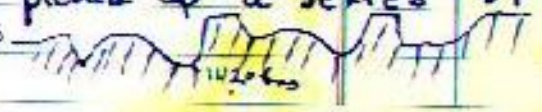
9 May, 1964 – Still channel chasing

It is now just 4 AM, and I have just gone over with Dietz what I have been up to since 10:00 last evening when he left.

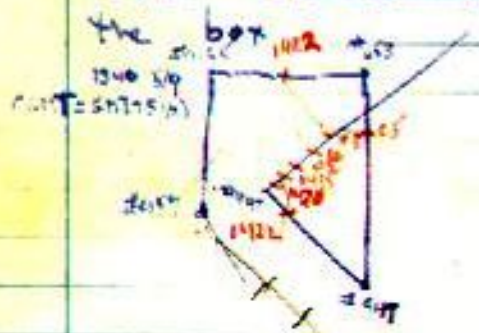
That next crossing on 240° was a double one with both valleys at about 1280 fms. I turned to 330° at 1:30 AM expecting to cross this double valley again – but didn't. There was one small depression at 2:22 AM, – only 15 fms deep with the bottom at 1230, and later on (at 3:02, 07, and 12) there were three small "dents" bottoming at 1230, but nothing looking like what we were after. So, we turned at 3:20 AM to 240°, and I left it all in Bob's lap with plotted cross sections of all crossings added to the growing pile clipped to a clipboard and swinging to and fro with the roll.

This record makes terribly dull reading, but it is not written with a Nobel for literature in mind. It is purely and simply a record of what we are doing and where. It is just the same as the track lines on OOS sheets, lists of DR abstracts, core logs, dredge logs, PDR records, fix numbers, GMT notations, sea and swell logs, GEP records, biological logs, etc. – and just about as boring to read. Experience, however, has shown that such a log is highly useful later on when trying to recall some special incident or feature or as an aid in interpreting those lists, tapes, records, charts, etc.

Up a bit after 9 AM, and it had been fairly dull after I left. At 11:10 AM we picked up a series of 5 valleys.

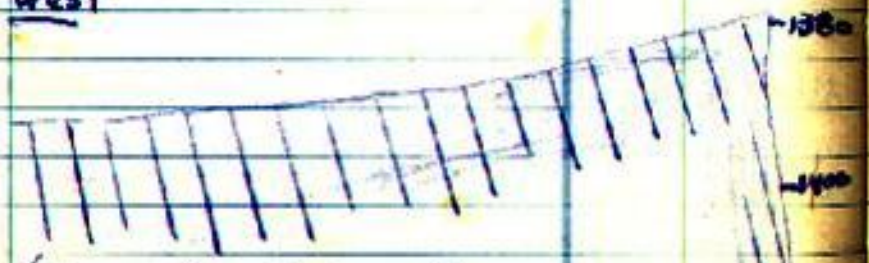


These are the best yet, so I had Ens Shimake have the course changed to 135° to see if they came in from the NW. Fran came in about then, and we did pick up one, but only one, so came north at 13:10 and again picked up only one, so came west at 1:05 PM to complete the box



At 1:20 PM we crossed a real beauty

West

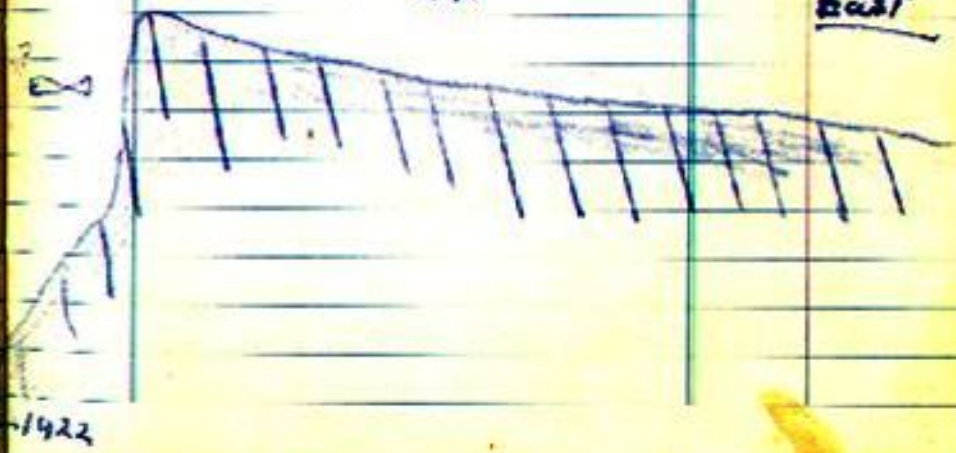


(Traced from fathogram)

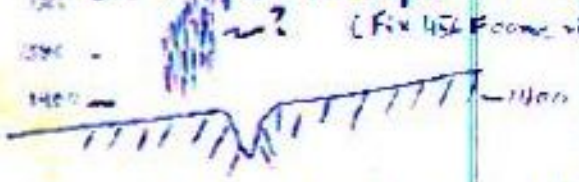
of a leveed channel with a levee top at 1380 fms and a bottom in an irregular Vee at 1422 fms. The back slopes of the levees fell off about 10 fms in ten minutes - at 2.35 KPH, that's 2.8 miles on a slope of 1 in 28. The equal height of the levee on either side and the even slopes suggest this crossing was about normal to the channel axis. This is a truly classic channel.

← 270° —

East



We turned south at 1:40 PM without meeting any more. At 2 PM we crossed a very small valley remarkable for the lack of levees and for the cloud of sound-reflecting something that hung over its south edge. Perhaps the reflections



came from fish who found additional nutrients here where the currents flowing along the bottom had been deflected upward. Perhaps too, I'm looking at a cloud of suspended sediment that is 240 feet high and 2400 feet wide (1½ minutes at 16 kts). Such a cloud might be expected if a turbidity current had passed recently with its down-slope edge mixing with the adjacent water which trapped some of the sediment. Since there were no levees on this crossing this mechanism - if that is what it is - could not have operated very often, or there would have been a levee developed.

At 2:30 PM at fix 457 we turned to 135° to head on down and maybe make some distance toward Colombo for a change. At quarter of six (1216 GCT) we came right to 225° after hitting only two relatively small valleys (at 1110 and 1151 GCT) with maximum depths below small levees of 20 and 10 fms at crossing depths of 1425 and 1450 fms.

That new course to the southwest heads us right into the seas that have been rising steadily all day. The ship rises high on a wave then slams down ~~with a~~ to shovel tons of water into the air and back over the Pioneer. We probably should have had the baffle boards up for chow tonight - it was messy. My ice tea ended up in Ens Jones lap and Col. Thorle's ice-water in mine. It is nice to

have seas like this for a spell, at least so long as we can continue to get soundings. The gravity went out due to heavy seas at 3:40 this afternoon, and I would like to get that back on the line. The Bay of Bengal gravity has not been of a very spectacular nature. Now that geo Peter has left, I am unable to get a running magnetic and gravity log and in truth do not know very much about what has been happening on the gravity and magnetics field. With Bud Jones due to come aboard at Colombo, we can get the geophysical events log rolling again.

In addition to Bud Jones, we'll also get Dick Perry, Ron Reed, and Abdulgani Ilahunde from Indonesia while losing Dietz, Shepard, Hale, DeWald, Harbison (2), Weeks, Mousla, Barbee, and Stewart. So we lose 9 and gain at least four plus a possible two or three Indian scientists.

Seawater temperature has really been up - now at 87.2° F. The grids on our BT's are calibrated in degrees Centigrade and only go up to 30° (86° F). The override probably does no harm to the BT, but the waters are indeed warm. The air is very very humid, and we all smell pretty ripe - even right after a shower. The wind has been about 25 knots but still is so hot and humid that it brings little relief.

At ten minutes of eight this evening we came left to 135° for what we hope will be a long cross-bay run. This will be a somewhat smoother course. By 11:00 PM no valleys had come in & I went to bed expecting a call about 03:30 to relieve Dick.

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Dietz got interested last night and just stuck with it until the biological tow about 5:30, so I was not wakened until 6:30. Seven hours of sleep - sweaty sleep, but still sleep.

Just after 12:30 AM, the ship crossed another channel in about 1565 fms. He came right to 225° for an hour getting no more crossing, so jogged west for a half hour before coming back to 135° at 2:30 AM. Still on this course now - at 9:30 AM - and we did get one nice valley complex ~~from~~ just after the biological tow (Lines 499 - 500 F). We did not develop it. My feeling is that we have passed the point where detailed ~~[illegible]~~ development of ~~[illegible]~~ single valleys is warranted. We are now after the big-Bay picture - trying to get a feel for the areal distribution of channels rather than bird-dogging a single one.

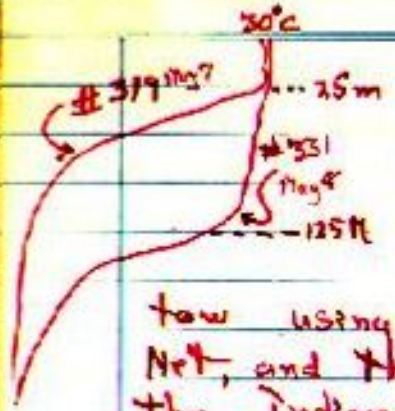
Our tentative plan now - and in an area like this where you never know what will come up, all plans must be tentative - is to continue on to the southeast to make a landfall on one of the Andamans, then come southwest to look at the area at about 87°30' E, 8°30' N where ARGO found a series of abrupt terraces. We may core and GEP there if they look good. Then on west to the Trincomalee Canyon area - staying the requested 6 miles offshore - where we can get some control and follow that canyon out.

As of now (8:00 AM) the floor is very smooth and sloping down very gently. Depth now is 1610 fms.

Have just had a good talk with G. Dick Stephen. He heard about the

biological data from now on, he will use the position numbers in his biological records, as this will be the best way for him to tie his data in with the other data we are getting.

I had spoken to him earlier on the trip regarding the report I got in Manila regarding the finding in the Bay of Bengal by the FAO people in Pakistan (Dacca) of an area of very clear and apparently non-productive waters. I asked him about their findings and if they had noted any such areas. On 8 May, their early morning vertical tow gave between 1/3 and 1/4 the usual amount of plankton, and the visibility vertically from their secchi disk reading was 40 meters as opposed to their more normal 20 to 25 meters. Their notes indicate that the sea was glassy with a good swell, so that would have allowed greater visibility from the ship down into the water. However, the vertical tow the day before (7 May) had a secchi disk visibility of 21 meters, and the one the day after (9 May) had a visibility vertically of 27 meters. The position for that 8 May tow was 86°44'E, 18°02'N. The surface water temperature at the May 7, 8, & 9 stations was 29.4°, 29.5°, and 30.1° respectively showing merely a gradual increase. I went back to look at the BT's for these biological stations (BT #s 319, 331, and 341) and found a marked difference between the one ~~bef~~ on May 7th and the one on May 8th, although the one at the biological station on May 9th was similar to the one on the day before. In other words — perhaps simpler ones too — the station in question was the first station in an area of thermal structure quite different from what we had been in. The thermocline dropped just 100 meters between the 7 May tow and the one with the clear water and few plankton.

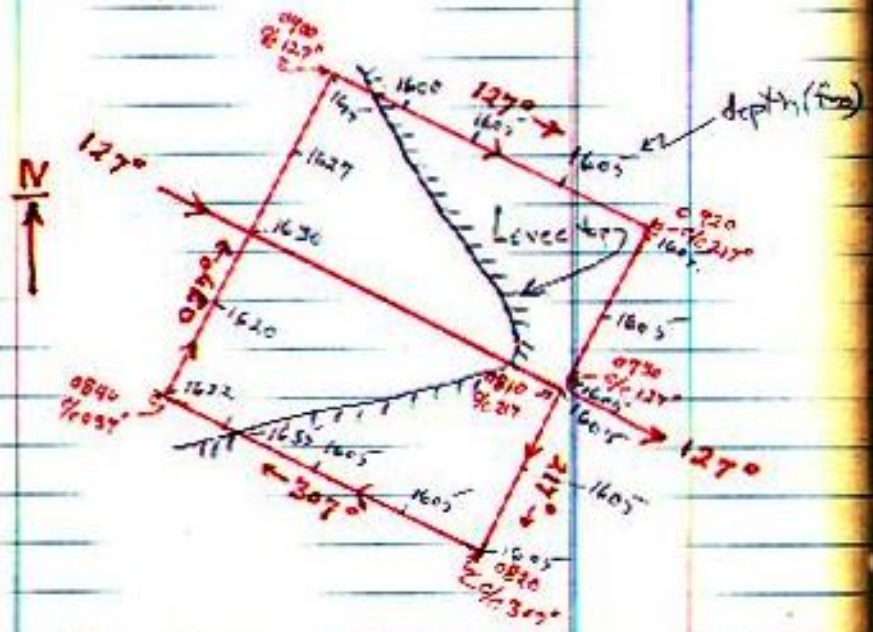


The night of May 8th in their horizontal tow, they got lots of juvenile shrimp 2-3 inches in length. This was the tow using the Indian Ocean Standard Net, and the samples will go to the Indian Ocean Biological Center at Cochin, India. Had we known of this earlier, we might have taken an oceo. station for temperature, salinity, and dissolved oxygen on either side to see what really was going on. He will alert someone the next time such an anamolous bit comes up. For the record, the 7 May station was at 88°59' E, 18°19' N, and the 9 May station was at 86°54' E, 18°01' N.

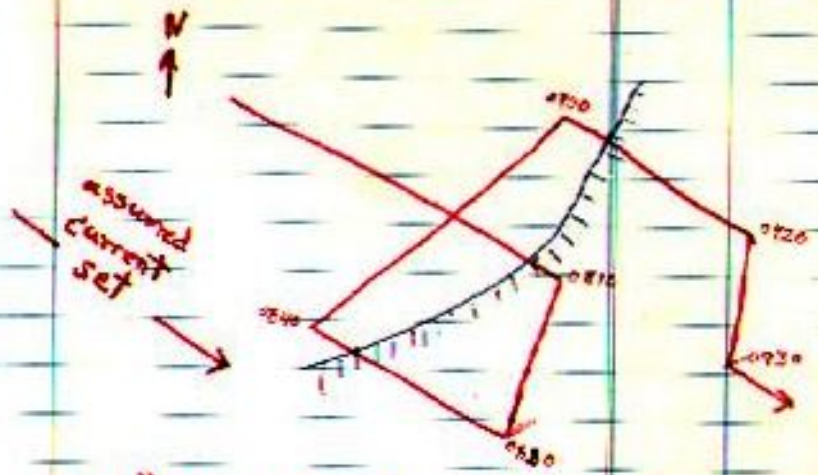
It is now 12:30 and we have been continuing on 135° headed for a landfall on one of the Andamans. Stars this morning were marginal at best. The bottom has been steady at about 1610 fms for the last several hours. I'm still passing up lunch and will sneak up to the flying bridge with the Captain's TIME magazine. I traded it on loan for my Kamasutra which he returned to me yesterday with a note saying it was interesting but perhaps better read at home than at sea. I'm inclined to agree with him!

At about 1:30 PM we ran into a complex of valleys and ridges of about 30 fms maximum relief lasting about 9 miles along the line we crossed them on. As earlier planned with the Captain, we ran a box — in this case 20 minutes on a side — around one part of it to see if we could determine the trend of the axis. I picked the pronounced levee where the crossing terminated on the southeast side, and we boxed it in. This

particular levee appears to trend about NE-SW. We had some drift, and I plan to re-plot it a few times assuming a constant drift and straight levee, and see how it looks.



This development, interesting though it was, completely fouled up my daily 2-hour sunbath on the flying bridge, but these are the sacrifices one must make! We may try



another one in case we come onto a small channel. It will be considerably easier, too, if the bottom has more of a slope than the 1605 fms area we operated in this trip.

16 lts = $\frac{6080 \times 16}{16}$

30450
6080

12 | 97280 ft/hour

6 | 8,107 ft/5 min

1,351 fms/5 min

1. working up data –
2. practical aspects of it for layman –
3. uniqueness of simplicity [illegible] –
4. [illegible] of [illegible] – [illegible] for [illegible]
5. I.O. [illegible] an [illegible] lab.
6. [illegible] discipline in some [illegible] – [illegible] disadv.
7. [illegible] predictions for future –

SARMA (Apt S.D.) 236. Eqpt 36" [illegible] 16 ([illegible])

CHOOPOM
CDR Navayan N. Sathaye
CDR Raghuvir Y. Tambe
Hooghly River Survey
% Port Commissioners
15 Strand Rd.
Residences – Calcutta 1
A/5 & A/6 Nimak Mahal Road
Kidderpore,
Calcutta 43

Ná ma stě – ji (gtag)
Bahut Shúhreya – thanks –
Jai Hind (Jay hind)

18500
2
37000